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FORTY-SECOND ANNUAL REPORT
OF THE
SECRETARY
OF THE
STATE BOARD OF AGRICULTURE
OF THE
STATE OF MICHIGAN
AND
SIXTEENTH ANNUAL REPORT
OF THE
EXPERIMENT STATION
FROM
JULY 1, 1902, TO 'JUNE 30, 1903



BY AUTHORITY

LANSING, MICH.
ROBERT SMITH PRINTING CO., STATE PRINTERS AND BINDERS
1903

Sci 1635.12



The Board

REPORT OF THE SECRETARY
OF THE
STATE BOARD OF AGRICULTURE

AGRICULTURAL COLLEGE, *July 1, 1903.*

TO HONORABLE AARON T. BLISS,

Governor of the State of Michigan:

SIR—I have the honor to submit to you herewith, as required by law, the accompanying report for the fiscal year ending June 30, 1903, with supplementary papers.

Very respectfully,

ADDISON M. BROWN,

Secretary of the State Board of Agriculture.

STATE BOARD OF AGRICULTURE.

	Term expires
FRANKLIN WELLS, Constantine,	1907
PRESIDENT OF THE BOARD.	
ROBERT D. GRAHAM, Grand Rapids,	1905
L. WHITNEY WATKINS, Manchester,	1905
CHARLES J. MONROE, South Haven,	1907
AARON P. BLISS, Saginaw,	1909
WILLIAM H. WALLACE, Bayport,	1909
AARON T. BLISS, GOVERNOR OF THE STATE,	<i>Ex-Officio.</i>
JONATHAN L. SNYDER, PRES. OF COLLEGE,	

A. M. BROWN, Agricultural College, Secretary.
B. F. DAVIS, Lansing, Treasurer.

STANDING COMMITTEES.

The President of the Board is *ex-officio* a member of each of the Standing Committees.

FINANCE,	C. J. Monroe, A. P. Bliss.
FARM MANAGEMENT,	L. W. Watkins, R. D. Graham.
BOTANY AND HORTICULTURE,	R. D. Graham, C. J. Monroe.
BUILDINGS AND PROPERTY,	A. P. Bliss, R. D. Graham.
EMPLOYES,	R. D. Graham, C. J. Monroe, J. L. Snyder.
FARMERS' INSTITUTES,	C. J. Monroe, R. D. Graham.
MECHANICAL DEPARTMENT,	W. H. Wallace, C. J. Monroe.
MILITARY AND ATHLETICS,	L. W. Watkins, W. H. Wallace.
COLLEGE LAND GRANT,	L. W. Watkins, W. H. Wallace.
EXPERIMENT STATION,	C. J. Monroe, L. W. Watkins.
LIBRARY,	R. D. Graham, A. P. Bliss.
WOMEN'S DEPARTMENT,	W. H. Wallace, L. W. Watkins.
FORESTRY,	A. P. Bliss, C. J. Monroe.
CHEMICAL, PHYSICAL AND BACTERIOLOGICAL DEPARTMENTS	A. P. Bliss, L. W. Watkins.
ENGLISH AND MATHEMATICAL DEPT.,	W. H. Wallace, A. P. Bliss.

STATE AGRICULTURAL COLLEGE.

(Under control of the State Board of Agriculture.)

FACULTY AND OTHER OFFICERS.

- JONATHAN L. SNYDER, A. M., Ph. D., President; ^{a b c} Feb. 25, '96.
- *ROBERT C. KEDZIE, M. A., M. D., D. Sc., LL. D., Professor of Chemistry and Curator of the Chemical Laboratory; ^{a b c} Feb. 25, '63.
- WM. J. BEAL, A. M., M. S., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum; ^{a b} July 9, '70; ^c Feb. 22, '71.
- FRANK S. KEDZIE, M. S., Professor of Chemistry; ^a Sept. 15, '80; ^{b c} Sept. 1, '02.
- LEVI R. TAFT, M. S., Superintendent of Farmers' Institutes and State Inspector of Orchards and Nurseries; ^a Aug. 1, '88; ^{b c} July 1, '02.
- HOWARD EDWARDS, M. A., LL. D., Professor of English Literature and Modern Languages; ^{a b c} Aug. 25, '90.
- HERMAN K. VEDDER, C. E., Professor of Mathematics and Civil Engineering; ^{a b c} Sept. 15, '91.
- CLINTON D. SMITH, M. S., Dean of Short Courses, College Extension Lecturer; ^{a b} Sept. 1, '93; ^c July 1, '99.
- CHAS. L. WEIL, B. S., Professor of Mechanical Engineering and Director of the Mechanical Department; ^{a b c} Sept. 1, '93.
- WALTER B. BARROWS, B. S., Professor of Zoölogy and Physiology, and Curator of the General Museum; ^{a b c} Feb. 15, '94.
- GEORGE A. WATERMAN, B. S., M. D. C., Professor of Veterinary Science; ^{a b c} Sept. 1, '98.
- ROBERT S. SHAW, B. S. A., Professor of Agriculture and Superintendent of Farm; ^{a b c} Sept. 1, '02.
- ULYSSES P. HEDRICK, M. S., Professor of Horticulture and Landscape Gardening, and Superintendent of the grounds; ^a Sept. 1, '99; ^{b c} July 1, '02.
- CHARLES E. MARSHALL, Ph. D., Professor of Bacteriology and Hygiene; ^a Sept. 1, '98; ^{b c} Sept. 1, '02.
- JOSEPH A. JEFFERY, B. S. Agr., Professor of Agronomy and Soil Physics; ^a Sept. 1, '99; ^{b c} Nov. 11, '02.
- MAUD GILCHRIST, B. S., Dean of the Women's Department; ^{a b c} Sept. 1, '01.
- ADDISON M. BROWN, A. B., Secretary; ^{a b c} June 1, '02.

- MAJOR CHARLES A. VERNOU, U. S. A., Professor of Military Science and Tactics; ^{a b c} Oct. 6, '00.
- WILLIAM S. HOLDSWORTH, M. S., Assistant Professor of Drawing; ^a Feb. 22, '81; ^b Aug. 22, '87; ^c Jan. 1, '90.
- WILBUR O. HEDRICK, M. S., Assistant Professor of History and Political Economy; ^{a b} Aug. 24, '91; ^c Sept. 1, '93.
- WARREN BABCOCK, B. S., Assistant Professor of Mathematics; ^{a b} June 30, '91; ^c Sept. 1, '93.
- *CHARLES F. WHEELER, B. S., Assistant Professor of Botany; ^{a b} Mar. 1, '90; ^c Jan. 1, '96.
- *GEORGIANA BLUNT, Ph. M., Assistant Professor of English and Modern Languages; ^{a b c} Sept. 1, '98.
- MARTIN D. ATKINS, A. B., Assistant Professor of Physics and Electrical Engineering; ^{a b c} Sept. 1, '99.
- E. SYLVESTER KING, Assistant Professor in English; ^a Jan. 1, '00; ^{b c} Sept. 1, '02.
- HERMAN W. REYNOLDS, B. S. in M. E., Assistant Professor in Mechanical Engineering; ^a Sept. 1, '00; ^{b c} Sept. 1, '02.
- JAMES B. DANDENO, Assistant Professor in Botany; ^{a b c} Sept. 1, '02.
- GEORGE E. DENMAN, Director of Physical Culture; ^{a b c} Sept. 1, '01.
- MRS. LINDA E. LANDON, Librarian; ^{a b c} Aug. 24, '91.
- H. K. PATRIARCHE, B. S., Assistant Librarian; ^{a b c} Sept. 1, '02.
- BURTON O. LONGYEAR, Instructor in Botany; ^{a b c} Feb. 15, '94.
- RUFUS H. PETTIT, B. S. Agr., Instructor in Zoölogy; ^{a b c} Feb. 1, '97.
- *MRS. MAUD A. MARSHALL, Instructor in Music; ^{a b c} Sept. 1, '97.
- MRS. JENNIE L. K. HANER, Instructor in Sewing; ^{a b c} Sept. 1, '97.
- CAROLINE L. HOLT, Instructor in Drawing; ^{a b c} Sept. 1, '98.
- CHACE NEWMAN, Instructor in Mechanical Drawing; ^{a b} Sept. 1, '97; ^c July 23, '01.
- *JOHN J. FERGUSON, B. S. Agr., Instructor in Animal Husbandry; ^{a b} Sept. 1, '99; ^c Sept. 1, '01.
- *BELLE C. CROWE, Instructor in Domestic Science; ^{a b c} Oct. 1, '99.
- †ALBERT H. TAYLOR, Instructor in Physics; ^{a b c} Sept. 1, '00.
- *LESLIE L. LOCKE, M. A., Instructor in Mathematics; ^{a b c} Sept. 1, '00.
- ALFRED H. PARROT, M. A., Instructor in Mathematics; ^{a b c} Sept. 1, '00.
- BERTHA M. WELLMAN, B. S., B. Pd., Instructor in English; ^{a b c} Sept. 1, '00.
- JESSE J. MYERS, B. S., Instructor in Zoölogy; ^{a b c} Sept. 1, '01.
- S. FRED EDWARDS, B. S., Instructor in Bacteriology and Hygiene; ^{a b c} Sept. 1, '00.
- JOHN MICHELS, B. S. Agr., Instructor in Dairying; ^{a b c} Sept. 1, '00.
- CARRIE A. LYFORD, B. L., Instructor in Domestic Science; ^a Sept. 1, '00; ^{b c} Sept. 1, '02.
- SARAH B. S. AVERY, Instructor in Gymnastics; ^{a b c} Sept. 1, '00.
- PHILIP H. STEVENS, A. B., Instructor in English; ^{a b c} Sept. 1, '01.
- THOMAS GUNSON, Instructor in Floriculture and Foreman of Greenhouse; ^{a b} April 1, '91; ^c March 1, '01.
- GEORGE C. HUMPHREY, B. S., Instructor in Animal Husbandry; ^{a b c} Sept. 1, '01.

* Resigned September 1, '03.

† Resigned February 7, '03.

*GEORGE SEVERANCE, B. S., Instructor in Agriculture; ^{a b c} Sept. 1, '01.
 WALTER W. WELLS, B. S., Instructor in Mechanical Engineering; ^{a b c}
 Sept. 1, '01.

LESLIE A. WATERBURY, Instructor in Mathematics; ^{a b c} Sept. 1, '02.

LEROY F. HARZA, Instructor in Mathematics; ^{a b c} Sept. 1, '02.

WRIGHT A. GARDNER, Instructor in Mathematics; ^{a b c} Oct. 1, '02.

ANDREW KRENTEL, Foreman Wood Shop; ^{a b c} Sept. 1, '02.

†A. E. KOCHER, Instructor in Agriculture; ^{a b c} Aug. 15, '02.

O. H. SKINNER, Instructor in Agriculture; ^{a b c} Mar. 20, '03.

JENNETTE CARPENTER, Instructor in Cookery; ^{a b c} Sept. 1, '02.

LOUISE FREYHOFER, Instructor in Music; ^{a b c} Sept. 1, '02.

MRS. MAE GINGLES, Instructor in Sewing; ^{a b c} Sept. 1, '02.

L. W. SAWTELLE, Instructor in English; ^{a b c} Sept. 1, '02.

L. G. HOLBROOK, Instructor in Physics; ^{a b c} Sept. 1, '02.

‡R. C. BENNER, Instructor in Chemistry; ^{a b c} Sept. 1, '02.

HARRY S. REED, Instructor in Chemistry; ^{a b c} Sept. 1, '02.

ROWENA KETCHAM, in charge of College Hospital; ^{a b c} Sept. 1, '00.

FRED C. KENNEY, Cashier; ^{a b} Sept. 18, '95; ^c Oct. 1, '97.

¶W. R. BRADFORD, Foreman of Wood Shop; ^{a b c} Nov. 1, '97.

W. S. LEONARD, Foreman of Machine Shop; ^{a b c} Sept. 1, '96.

E. C. BAKER, Foreman of Foundry; ^{a b c} Nov. 1, '97.

E. R. BLAIR, Foreman of Farm; ^{a b c} Sept. 1, '99.

PAUL THEADORE, Foreman of Forge Shop.

HENRY SHERMAN, Foreman of Grounds; ^{a b c} Sept. 1, '01.

¶¶B. A. FAUNCE, Clerk to President; ^{a b c} Sept. 1, '99.

C. A. STILES, Clerk to President; ^{a b c} Jan. 1, '03.

**CLARA A. HINMAN, Bookkeeper; ^{a b c} May 1, '99.

LENA M. MAXWELL, Bookkeeper; ^{a b c} July 1, '02.

***JULIA M. BALDWIN, Clerk to Secretary; ^{a b c} Feb. 1, '98.

S. ALICE EARL, Clerk to Secretary; ^{a b c} Oct. 1, '02.

L. F. NEWELL, Engineer; ^{a b c} Jan. 1, '98.

E. A. BOWD, Architect; ^{a b c} Jan. 1, '02.

* Resigned August 15 '02.

† Resigned March 20, '02.

‡ Resigned February 28, '03.

¶ Resigned September 1, '02.

¶¶ Resigned January 10, '03.

** Resigned August 7, '12.

*** Resigned October 1, '02.

a First appointment.

b Present appointment.

c Present title.

AGRICULTURAL EXPERIMENT STATION

OF THE

MICHIGAN AGRICULTURAL COLLEGE.

(Under the control of the State Board of Agriculture.)

STATION COUNCIL.

J. L. SNYDER, M. A., Ph. D., Pres., <i>Ex-officio</i> Member.	F. W. ROBISON, B. S. - Chemist.
CLINTON D. SMITH, M. S., Director.	F. S. KEDZIE, M. S. Associate Chemist.
L. R. TAFT, M. S., - Horticulturist.	CHAS. E. MARSHALL, Ph. D., - Bacteriologist and Hygienist.
*ROBT C. KEDZIE, M. A., M. D., D. Sc., LL. D., - - - Chemist.	R. S. SHAW, B. S. A. Experimenter with Live Stock.
	A. M. BROWN, A. B., Sec. and Treas.

ADVISORY AND ASSISTANT STAFF.

M. L. DEAN, - Asst. in Horticulture.	T. A. FARRAND, - In charge of South Haven sub-station.
GEO. A. WATERMAN, V. S., M. D. C., Consulting Veterinarian.	MRS. L. E. LANDON, - Librarian.
B. O. LONGYEAR, B. S., Acting Consulting Botanist.	S. FRED EDWARDS, B. S., - Asst. in Bacteriology and Hygiene.
R. H. PETTIT, B. S. A., Consulting Entomologist.	LEO M. GEISMAR, Chatham, in charge of Upper Peninsula Experiment Station.

SUB-STATIONS.

Grayling, Crawford county, 80 acres deeded. □
South Haven, Van Buren county, 10 acres rented; 5 acres deeded. Local Agent,
T. A. Farrand.
Chatham, Alger county, 160 acres deeded. Local Agent, Leo M. Geismar.

STANDING COMMITTEE IN CHARGE

HON. CHARLES J. MONROE, - - - - -	South Haven.
HON. L. WHITNEY WATKINS, - - - - -	Manchester.

STATE WEATHER SERVICE.

(Under the control of the State Board of Agriculture.)

OFFICERS OF THE SERVICE.

DIRECTOR, - - - - - C. F. Schneider, U. S. Weather Service.

* Died Nov. 7, 1902.

ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE YEAR ENDING JUNE 30, 1903.

SECRETARY'S FINANCIAL REPORT.

		Dr.	Cr.
July 1, 1902.	To cash on hand.....	\$1,230 97	
July 1, 1902	To cash on deposit, college treasurer.....	6,536 46	
June 30, 1903.	To special appropriation receipts:		
	From State Treasurer.....	\$45,700 00	
	From United States Treasurer.....	15,000 00	
	From institution and other sources.....	6,267 37	
		66,967 37	
June 30, 1903.	By special appropriation disbursements.....		\$65,601 80
June 30, 1903.	To current account receipts:		
	From State Treasurer, land grant interest.....	\$65,573 90	
	One-tenth mill tax.....	60,000 00	
	From United States Treasurer.....	25,000 00	
	From institution and other sources.....	43,490 22	
	From South Haven Experiment Station.....	587 45	
	From Upper Peninsula Experiment Station.....		
	From Farmers' Institutes.....	75 51	
		194,727 08	
	By general account disbursements:		
	Current account.....	\$178,127 78	
	Supplementary accounts.....	15,838 10	
			193,965 88
	By cash on deposit, college treasurer.....		6,025 74
	By cash on hand.....		3,668 46
		\$269,461 88	\$269,461 88

TABLE NO. 1.—*Tabular exhibit of secretary's report.*

	Balance sheet, July 1, 1902.		Transactions, July 1, 1902, to June 30, 1903.		Balance sheet, June 30, 1903.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash.....	\$1,230 97			\$2,437 49	\$3,668 46	
College treasurer*.....	6,536 46		\$510 72		6,025 74	
Special appropriations.....		\$7,708 15	66,967 37	65,801 80		\$8,873 72
Current accounts.....		59 28	194,727 08	178,127 78		880 48
Supplementary accounts.....				15,838 10		
Tota's.....	\$7,767 43	\$7,767 43	\$262,205 17	\$262,205 17	\$9,694 20	\$9,694 20

* Treasurer's statement is greater July 1, 1902, by \$3,748.20, and June 30, 1903, by \$6,025 74 warrants outstanding.

TREASURER'S ACCOUNT.

	Dr.	Cr.
Balance on hand July 1, 1903.....	\$10,284 66	
Receipts from State Treasurer and secretary.....	258,998 67	
Interest on deposits, 12 months at 2½ per cent.....	2 0 11	
Warrants paid July 1, 1902, to June 30, 1903.....		\$256,946 93
Balance on hand June 30, 1903.....		12,576 51
Total.....	\$269,523 44	\$269,523 44

TABLE NO. 2. —Statement of special appropriation account for fiscal year July 1, 1902, to June 30, 1903.

Name of appropriation.	Balance of accounts, July 1, 1902.		Receipts during fiscal year.		Total available.	Total expended.	Balance of accounts, June 30, 1903.	
	Dr.	Cr.	From State treasury.	From institution and other sources.			Dr.	Cr.
Experiment station.....		\$124 95	\$15,000 00	\$4,812 87	\$19,887 82	\$19,866 76		\$81 07
Weather service.....		66 55	1,000 00		1,066 55	1,067 72	\$1 18	
Bacteriological laboratory.....		6,004 35	17,000 00		23,004 35	23,064 35		
Nursery license and inspection.....		85 00		1,454 50	1,539 50	1,368 25		201 25
Power plant.....		1,367 80			1,367 80	1,368 90		998 40
Bath house.....			18,000 00		18,000 00	14,664 12		3,335 87
Post office and depot building.....			1,700 00		1,700 00	1,700 00		
Water system.....			8,000 00		8,000 00	3,741 60		4,258 31
Balance.....	\$7,708 15						8,873 72	
Total.....	\$7,708 15	\$7,708 15	\$30,700 00	\$6,267 37	\$74,675 52	\$65,801 80	\$8,874 90	\$8,874 90

* \$15,000 from United States Treasury.

STATE BOARD OF AGRICULTURE.

TABLE NO. 3.—Current account, July 1, 1902, to June 30, 1903.

On account of—	Dr. To disburse- ments.	Cr. By receipts.
U. S. Treasurer, fourteenth annual payment under act of congress of August 30, 1890		\$25,000 00
State Treasurer, one-tenth mill tax		60,000 00
State treasurer, interest on proceeds of sales of U. S. land grant		66,573 90
Salaries	\$62,674 95	107 07
Farm department	14,996 05	8,451 15
Horticultural department	7,328 71	3,602 06
Mechanical department	6,759 28	1,645 04
Heating department	20,875 18	1,604 57
Cleaning department	2,050 90	105 35
Electric lighting department	6,187 35	995 88
Office	1,920 90	57 03
Advertising	2,206 44	
M. A. C. Record	1,015 64	471 15
Special courses	2,191 42	825 26
Academic departments	22,574 13	4,855 01
Contingent building	23 115 92	19,424 90
Miscellaneous	4,230 91	945 73
Total	\$178,127 78	\$194,064 12
Supplementary amounts:		
Bulletins	2,603 90	
Farmers' institutes	7,892 84	75 51
South Haven experiment station	2,071 43	587 45
Upper Peninsula experiment station	3,269 93	
Balance at beginning of period, July 1, 1902		59 29
Balance at close of period, June 30, 1903	820 48	
Total	\$194,786 36	\$194,786 36

TABLE NO. 4.—Experiment station account, July 1, 1902, to June 30, 1903.

On account of—	Dr. To disburse- ments.	Cr. By receipts.
Balance from fiscal year, July 1, 1902		\$124 95
U. S. Treasurer for fiscal year		15,000 00
Fertilizer license fees		2,120 60
Salaries	\$7,663 51	7 00
Farm department	5,921 17	2,681 10
Horticultural department	413 48	
Chemical department	1,261 75	
Botanical department	32 17	
Entomological department	311 80	3 90
Library	227 35	
Sundry	258 83	87
Secretary's office	605 40	
Veterinary	50 06	
Bacteriological stable	1,999 53	
Bacteriological department	1,121 75	
Balance on hand, June 30, 1903, close of fiscal year	81 07	
Total	\$19,937 82	\$19,937 82

TABLE NO. 5.—Regular employes and salaries.

Officers.	Rate per year.	Classification.		Other sources	
		Current.	Experim't station.		
	3200	3200			
President.....	80,000 00	80,000 00			Dwelling
Professor of botany.....	1,800 00	1,800 00			"
Superintendent of farmers' institutes and State inspector of orchards and nurseries	1,800 00	500 00	800 00	8700 00	"
Professor of English literature and modern languages.....	1,800 00	1,800 00			"
Professor of mathematics and civil engi- neering.....	1,800 00	1,800 00			"
Dean of short courses, college extension lecturer and director of experiment stat'n	2,000 00	400 00	1,600 00		"
Professor of mechanical engineering and director of the mechanical department....	1,800 00	1,800 00			"
Professor of zoology and physiology and curator of the general museum.....	1,800 00	1,800 00			"
Professor of veterinary science.....	1,500 00	1,200 00	300 00		"
Dean of the women's department.....	1,300 00	1,300 00			Rooms.
Secretary.....	1,800 00	300 00	500 00	1,000 00	Dwelling.
Professor of military science and tactics*..	576 00	576 00			
" " chemistry.....	2,000 00	1,700 00	300 00		
" " bacteriology and hygiene.....	1,800 00	800 00	1,000 00		
" " horticulture and landscape gar- dening, and superintendent of the horti- cultural department.....	2,000 00	2,000 00			
Professor of agriculture and superintendent of farm.....	2,400 00	2,000 00	400 00		
Professor of soil physics and agronomy.....	2,000 00	2,000 00			
" " forestry.....	1,500 00	1,500 00			
Assistant professor of drawing.....	1,600 00	1,600 00			
" " " history and political economy.....	1,200 00	1,100 00		100 00	Rooms
Assistant professor of mathematics.....	1,250 00	1,250 00			"
" " physics and electrical engineering.....	1,450 00	1,450 00			"
Ass't professor of mechanical engineering..	1,200 00	1,200 00			
" " " English and modern lan- guages.....	1,000 00	1,000 00			Rooms
Assistant professor of botany.....	1,150 00	1,150 00			
Director of physical culture.....	1,250 00	1,250 00			
Librarian.....	1,000 00	880 00	120 00		Rooms.
Instructor in botany.....	700 00	600 00	100 00		
" " zoology.....	1,100 00	500 00	600 00		Dwelling.
" " domestic art.....	800 00	800 00			Room.
" " drawing.....	700 00	700 00			
" " mechanical drawing.....	900 00	900 00			
" " physics.....	700 00	700 00			
" " mathematics.....	600 00	600 00			
" " English.....	550 00	550 00			
" " bacteriology and hygiene.....	500 00	350 00	150 00		
" " dairying.....	880 00	880 00			
" " domestic science.....	700 00	700 00			Room.
" " gymnastics.....	550 00	550 00			"
" " floriculture and foreman of greenhouse.....	1,000 00	1,000 00			Dwelling
Instructor in English.....	550 00	550 00			
" " zoology.....	600 00	600 00			
" " animal husbandry.....	800 00	800 00			
" " mechanical engineering.....	650 00	650 00			
" " chemistry.....	700 00	700 00			
" " physics.....	500 00	500 00			
" " English.....	700 00	700 00			
" " domestic science.....	500 00	500 00			Room.
" " agriculture.....	550 00	550 00			
" " music.....	700 00	700 00			

* In lieu of quarters. Salary paid by U. S. government.

TABLE No. 5.—*Concluded.*

Officers.	Rate per year.	Classification.		Other sources.	
		Current.	Experi'm't station.		
Instructor in mathematics and civil engineering.....	\$750 00	\$750 00			
Instructor in mathematics.....	500 00	500 00			
Foreman of machine shop.....	1,000 00	1,000 00			
" " foundry.....	750 00	750 00			
" " wood shop.....	700 00	700 00			
Assistant in sewing.....	150 00	150 00			
Cashier.....	1,200 00	1,000 00	\$200 00		
Foreman of college farm.....	550 00	550 00			Dwelling.
" " grounds.....	480 00	480 00			"
Book-keeper.....	600 00	500 00	100 00		
Clerk to president.....	700 00	700 00			
Assistant librarian.....	350 00	350 00			
Engineer.....	900 00	900 00			Dwelling
Nurse in charge of college hospital.....	450 00	450 00			"
Total.....	\$68,276 00	\$60,506 00	\$6,970 00	\$1,800 00	

TABLE NO. 6.—Income of the State Agricultural College from all outside sources from the date of its foundation to the present time.

Year.	From State Legislature.			From U. S. Congress.			Total.
	For current expenses.	For special purposes.	Land sales salt spring and swamp land grants.	Morrill act of 1862, interest from land grant and trespass.	Hatch act of 1887, experiment station.	Morrill act of 1890, supplementary endowment.	
1855.....			\$56,320 00				\$56,320 00
1856.....							
1857.....	\$40,000 00						40,000 00
1858.....							
1859.....	37,500 00						37,500 00
1860.....							
1861.....	6,500 00		152 25				6,652 25
1862.....	10,000 00		218 97				10,218 97
1863.....	9,000 00		407 80				9,407 80
1864.....	9,000 00		736 09				9,736 09
1865.....	15,000 00		1,156 61				16,156 61
1866.....	15,000 00		1,094 27				16,094 27
1867.....	20,000 00		7,608 38				27,608 38
1868.....	20,000 00		592 49				20,592 49
1869.....	20,000 00	\$30,000 00	17,559 00	\$58 96			67,617 96
1870.....	20,000 00		1,320 02	3,730 93			34,040 95
1871.....	18,250 00	10,500 00	4,135 72	3,785 54			36,671 56
1872.....	18,250 00	8,000 00	217 06	7,176 65			28,642 70
1873.....	21,796 00	15,602 00	10 13	11,059 08			48,467 19
1874.....	13,000 00	15,602 00	150 13	14,061 98			42,814 11
1875.....	7,638 00	7,755 50	144 53	14,446 14			29,984 17
1876.....	7,638 00	6,755 50	1,773 09	16,830 17			32,996 76
1877.....	6,150 00	30,686 80	979 06	15,172 86			52,988 72
1878.....	6,150 00	5,636 80	536 60	15,807 09			28,470 49
1879.....	4,971 80	16,068 32	712 23	16,975 32			38,736 56
1880.....	4,971 80	7,068 32	797 55	17,837 24			30,674 91
1881.....	7,249 00	43,720 50	461 95	20,935 35			72,366 70
1882.....	7,249 00	8,945 50	358 46	22,507 45			39,060 41
1883.....	8,335 00	23,753 00	391 95	30,749 60			63,319 55
1884.....	8,335 00	10,536 00	1,259 90	27,909 72			48,080 62
1885.....		35,103 00	187 50	29,770 40			65,060 90
1886.....		22,617 00		30,461 04			53,078 04
1887.....		* 44,040 00	198 20	24,611 37			68,849 57
1888.....		30,752 50	144 20	32,406 60	\$15,000 00		78,303 30
1889.....		* 20,973 00	10 50	31,322 69	15,000 00		67,306 19
1890.....		* 27,172 00	238 50	32,360 64	15,000 00	\$15,000 00	89,771 14
1891.....		22,947 50	37 38	34,750 54	15,000 00	16,000 00	88,735 42
1892.....		22,947 50	137 38	34,948 12	15,000 00	17,000 00	90,033 00
1893.....		18,862 50	10 50	37,927 04	15,000 00	18,000 00	89,800 04
1894.....		18,862 50	433 59	44,527 26	15,000 00	19,000 00	97,823 35
1895.....		† 19,000 00	10 50	45,301 25	15,000 00	20,000 00	99,312 25
1896.....		† 16,000 00		43,886 40	15,000 00	21,000 00	95,886 40
1897.....		† 17,700 00		43,779 54	15,000 00	22,000 00	98,479 54
1898.....		† 17,500 00		47,508 28	15,000 00	23,000 00	103,008 28
1899.....		† 8,750 00	705 00	52,526 11	15,000 00	24,000 00	100,981 11
1900.....		72,500 00	175 00	72,296 38	15,000 00	25,000 00	184,973 38
1901||.....		72,500 00		63,976 79	15,000 00	25,000 00	176,476 79
1902.....	100,000 00	† 1,000 00		64,081 81	15,000 00	25,000 00	205,081 81
1903.....	100,000 00	† 1,000 00		65,573 90	15,000 00	25,000 00	206,573 90
Totals	\$562,023 60	\$725,937 74	\$101,662 47	\$1,070,054 92	\$240,000 00	\$225,000 00	\$2,994,768 73

* Including appropriations for weather service.

† October 1, 1896, to June 30, 1897, nine months.

|| Including \$5,000 for institutes and \$1,000 for weather service.

† Including \$2,750 for institutes and \$500 for weather service.

† Including \$5,500 for institutes and \$1,000 for weather service.

† Including \$5,500 for institutes and \$1,000 for weather service.

|| To June 30.

†† Weather service.

SUMMARY OF INVENTORY, JUNE 30, 1902.

College farm and park, 671 acres @ \$70.....		\$46,970 00
Athletic field and drive, 13 acres @ \$87.50.....		1,137 50
Buildings—		
Library and museum, built 1881.....	\$22,000 00	
College hall, built 1856.....	17,000 00	
Williams hall, built 1869.....	30,000 00	
Wells hall, built 1877.....	20,000 00	
Abbot hall, built 1888, add. in 1896.....	15,000 00	
Chemical laboratory, built 1871, south end add. '81	18,000 00	
Machine shops and foundry, 1885, so. end add. '87	15,000 00	
Veterinary laboratory, built 1885.....	5,000 00	
Horticultural laboratory, built 1888.....	6,000 00	
Agricultural laboratory, built 1889, imp. 1897..	7,500 00	
Botanical laboratory, built 1892.....	10,000 00	
Armory, built 1885.....	6,000 00	
Greenhouses and stable, built 1873, 1879; rebuilt		
1892 and 1902.....	7,300 00	
Boiler house and chimney, built 1893-4.....	4,000 00	
President's and two frame dwellings, built 1874..	12,000 00	
Four brick dwellings, built 1857.....	10,000 00	
Two brick dwellings, built 1879 and 1884.....	6,000 00	
One frame dwelling, built 1885.....	3,500 00	
Howard terrace dwelling, built 1888.....	13,000 00	
Farm house dwelling, built 1869.....	2,000 00	
Herdsmen's dwelling, built 1867.....	400 00	
Ten barns at professors' houses.....	2,000 00	
Horticultural barn and shed, built 1868, '75, '87..	1,200 00	
Cattle barn and shed, built 1862.....	1,500 00	
Sheep barn, built 1865.....	1,000 00	
Horse barn, built 1871.....	1,000 00	
Pig barn, built 1871.....	1,000 00	
Corn barn, built 1878.....	400 00	
Grain barn, built 1881.....	1,600 00	
Horse sheds, built 1894.....	200 00	
Tool barn, built 1881.....	1,000 00	
Barn, built 1884.....	800 00	
Brickwork shop, built 1857.....	500 00	
Observatory, built 1880.....	150 00	
Bath house and fittings, built 1902-3.....	18,000 00	
Ice house, 1879.....	100 00	
Paint shop, built 1879.....	150 00	
Bee house, 1884, remodeled dwelling, '93, add. '00	1,000 00	
Hospital, 1894.....	3,000 00	
Poultry building and yards, 1894.....	625 00	
Dairy barn, built 1897.....	800 00	
Waiting room street car terminus, built 1902...	1,700 00	
Street car track and fixtures, 600 ft., built 1897..	360 00	
Lumber shed, mechanical department.....	250 00	
Silo.....	210 00	
Coal shed, built 1899.....	700 00	
Woman's building, built 1900.....	91,000 00	
Farm barn, built 1900.....	4,000 00	
Dairy building, built in 1900.....	15,000 00	
Bacteriological laboratory.....	27,000 00	
		405,945 00
Iron bridge over Cedar river, built 1888.....		1,500 00
Dynamo at Agricultural laboratory.....		280 00
Bridge to athletic field.....		516 50
Amount carried forward.....		\$456,349 00

AGRICULTURAL COLLEGE ACCOUNTS.

17

Amount brought forward..... \$456,349 00

Heat, light and water department—

Water works equipment.....	\$5,351 30
Electric light equipment.....	6,555 00
Steam heating plant No. 1.....	5,357 00
Steam heating plant No. 2.....	1,212 50
Steam heating plant No. 3.....	668 00
Steam and water stock.....	87 41
Steam and water tools and fixtures.....	442 50

19,673 71

Bacteriological Department—

Apparatus	\$2,555 79
Chemicals	114 82
Office fixtures	106 70

2,777 31

Botanical Department—

Herbarium	\$9,230 45
Museum	793 45
Books	302 61
Maps and charts.....	328 00
Negatives	220 40
Photographs and engravings.....	930 55
Lantern slides	247 50
Microscopes and accessories.....	1,452 92
Glassware	279 78
Chemicals, stains, etc.....	36 22
Office and class-room equipment.....	641 15
Garden tools	38 36
General equipment	68 38
Laboratory tools	108 08

14,677 85

Chemical Department—

Cases and fixtures.....	\$2,860 07
Specimens	334 00
Balances	1,658 25
Weights	666 67
Glassware ungraduated	2,728 44
Glassware graduated	556 42
Porcelain ware	311 14
Wooden apparatus	70 05
Rubber material	55 00
Platinum ware	2,083 70
Iron apparatus	354 18
Hoffman apparatus	147 50
Miscellaneous apparatus	2,238 72
Essay room supplies.....	219 49
Chemicals inorganic	729 82
Chemicals organic	198 41
Acids	123 60

15,335 46

Farm Department—

Live stock, cattle.....	\$8,060 00
Live stock, swine.....	774 00
Live stock, sheep.....	1,432 00
Live stock, horses.....	950 00
Soils laboratory	759 42
Lower class room.....	219 90
Tool barn	698 30
Students' tool room.....	180 81
Registered herd barn.....	85 15
Horse barn	246 89

13,456 47

Amount carried forward..... \$508,813 33

Amount brought forward.....		\$508,813 33
Farm Department—Continued.		
Dairy barn	\$31 70	
Grain barn	477 38	
Miscellaneous	139 00	
Wood	16 50	
Field crops	1,120 00	
Feed	389 25	
Farm house	114 90	
Office	520 20	
Office books and library.....	1,304 45	
Dairy	911 20	
		18,481 05
Horticultural Department—		
Heavy tools	\$696 80	
Teams, harness, etc.....	487 40	
Grafting and pruning tools, etc.....	297 00	
Carpenter tools	39 22	
Ice tools	41 75	
Animals in Zoo.....	175 00	
Spraying outfit	302 50	
Aquatic plants	45 00	
Class room	608 60	
Herbarium	140 00	
Seed room	22 50	
Laboratory and museum.....	259 33	
Small laboratory	35 20	
Office fixtures	276 07	
Green house tools	271 50	
Green house plants	2,040 77	
		5,738 64
Department of Mathematics and Civil Engineering—		
Surveying instruments	\$3,042 88	
Photographic material	47 50	
Tools and apparatus	503 18	
Books and pamphlets	38 57	
Office furniture	337 93	
Engineering class room	99 00	
Astronomical laboratory	838 50	
		5,321 86
Mechanical Department—		
Office and class room fixtures.....	\$2,294 02	
Experimental laboratory instruments.....	2,027 46	
Experimental laboratory apparatus.....	3,486 20	
Drawing and mathematical instruments.....	161 14	
Iron-working machinery	4,863 79	
Small iron-working tools	1,931 76	
Wood-working machinery	1,532 36	
Small wood-working tools.....	860 40	
Forge shop	694 13	
Foundry	605 44	
Belting, pulleys, shafting, etc.....	407 03	
Office supplies and stock.....	502 18	
Sundry supplies	193 82	
Machine shop, stock.....	1,208 38	
Foundry, stock	296 75	
Wood shop, stock.....	601 75	
Forge shop, stock.....	40 62	
		21,707 23
Department of Physical Culture—		
Men's gymnasium	\$593 41	
Women's gymnasium	418 46	
		1,011 87
Amount carried forward.....		\$561,073 98

AGRICULTURAL COLLEGE ACCOUNTS.

19

Amount brought forward.....		\$561,073 98
Women's Department—		
Furniture, musical instruments, etc.....	\$3,970 73	
Cooking school	482 10	
Wood-working room	443 59	
Library	113 76	
Offices	186 75	
Miscellaneous	121 95	
		5,318 88
Department of Zoology and Geology—		
General museum	\$17,873 75	
Furniture and general apparatus.....	1,165 40	
Tools	26 55	
Dissecting instruments	649 81	
Office supplies	815 90	
		20,531 41
Drawing Department—Furniture and equipment.....		2,158 89
English Department—Furniture and equipment.....		249 75
Forestry Department—Furniture, tools, etc.....		368 45
Department of History and Economics.....		177 85
Library		43,859 38
Military Department		746 55
Physical Department—Apparatus and equipment.....		7,136 47
President's Office		589 97
Secretary's Office		1,949 90
Veterinary Department—Apparatus and equipment.....		1,690 35
Hospital		159 59
Farmers' Institutes		636 51
Board Rooms		332 95
Post Office		314 50
Weather Bureau		1,884 72
Guest room		57 50
Cleaning supplies		255 47
Furniture in Chapel.....		276 10
Total		\$649,769 17

SUMMARY OF EXPERIMENT STATION INVENTORY.

Lands donated to the Station—			
80 acres at Grayling, fenced and improved at cost	\$1,000 00		
5 acres at South Haven, fenced and improved...	1,000 00		
160 acres at Chatham, including buildings.....	4,000 00		
			\$6,000 00
Buildings—			
Bacteriological stable	\$3,700 00		
Experiment feed barn.....	800 00		
Veterinary laboratory, experimental rooms.....	250 00		
Apiary	600 00		
Feed mill	100 00		
Station Terrace building	3,000 00		
Seed room	500 00		
Poultry house and yards.....	625 00		
Storage barn	600 00		
Cold storage fruit house.....	1,000 00		
			11,175 00
Bacteriological Department—			
Apparatus	\$2,149 02		
Chemicals	458 68		
			2,607 70
Botanical Department—			
Microscopes	\$438 92		
Apparatus	47 95		
Furniture	66 00		
Stationery	17 07		
			569 94
Chemical Department—			
Furniture and office fixtures.....	\$51 50		
Porcelain ware	400 05		
Chemicals	84 26		
Apparatus	773 18		
Glassware	351 73		
			1,660 72
Entomological Department—			
Office equipment	\$472 40		
Apparatus	635 96		
Chemicals	39 20		
Books	75 85		
			1,223 41
Farm Department—			
Farm tools	\$779 56		
Office equipment	318 95		
Dairy	289 19		
Farm products	83 00		
			1,470 70
Horticultural Department—			
General apparatus	\$577 54		
Office equipment	171 22		
			748 76
Secretary's Office—			
Furniture	\$24 25		
Stationery and supplies.....	339 60		
Mailing list in type and maller.....	235 00		
			598 85
Library			3,541 50
South Haven Station, equipment.....			154 00
Upper Peninsula Station—			
Tools	\$247 35		
Field crops	29 68		
Office equipment	61 83		
			338 86
Total			\$30,089 44

DEPARTMENT REPORTS.

REPORT OF THE PRESIDENT.

To the Honorable State Board of Agriculture:

I beg leave to submit herewith my annual report for the year ending June 30, 1903. With this report will also be found the reports of heads of the different departments of the College.

The past year has been one of unusual progress in the history of the College. The attendance was much larger than ever before; the total enrollment numbering 854. The class rooms and teaching force of some departments were taxed almost to the extreme limit, yet good work was done; and on the whole very satisfactory progress made by students.

At the beginning of the year was inaugurated a course in Forestry. This course is the same in length as the other full courses and leads to the same degree. It is the purpose to give a few young men such training as will enable them to render valuable service to the State in taking care of and developing its large tracts of unproductive land.

ADDITIONS AND CHANGES IN FACULTY.

Mr. C. F. Wheeler, who had been assistant professor in botany for a number of years, resigned at the close of last year to accept a responsible position in the Department of Agriculture at Washington. Mr. Wheeler's services were very valuable to the College. In systematic botany he has few if any equals in this country. He is a fine teacher, and in the fullest sense a cultured gentleman. Prof. J. B. Dandeno, a graduate of Harvard, was elected to fill the position vacated by Prof. Wheeler.

After five years of faithful and very efficient service as instructor in music, Mrs. Maude Marshall resigned, and Miss Louise Freyhofer, a graduate of Berea College, Ohio, was selected to fill her place.

Mr. R. S. Shaw, professor of agriculture, Montana Agricultural College, was elected professor of agriculture to fill the vacancy caused by the resignation of Prof. Herbert Mumford one year before.

Prof. E. E. Bogue, a graduate of Ohio State University, and also of Harvard University, was placed at the head of the new department of forestry.

Dr. Robert C. Kedzie, who had charge of the department of chemistry for nearly forty years, passed away on November 7, 1902. At the beginning of the year, at his own request, he was relieved of all responsibility

and made Professor Emeritus. His son, Prof. Frank C. Kedzie, who had been his able assistant for a number of years, was given full charge of the department.

Dr. Kedzie was a great man and did a great work. It is pleasant to record that the Alumni have already taken measures to bring about the erection on the campus of a suitable memorial. Can we not hope that the College, in the not far distant future, may give to one of its new buildings the name which has for so many years brought honor and credit to the institution?

IMPROVEMENTS.

There have been completed during the year two buildings, both models of their kind—a bacteriological laboratory and a bath house for young men. Other buildings are very much needed, especially an engineering building and library and auditorium. The College could expend at once to good advantage five hundred thousand dollars in buildings.

It is the purpose to install, during the coming year, a new heating and electric lighting system at a cost of over one hundred thousand dollars.

Commencement week of this year was one of unusual pleasure. The fourteenth triennial reunion brought back two hundred twenty-five alumni. It does one good to stand on the side and see the old boys meet again.

The baccalaureate sermon was given this year by the Rev. J. M. Barkley, pastor of the Forest Avenue Presbyterian Church, Detroit, and the commencement address was delivered by Mr. Frank Miller, editor of the "American Machinist," New York City.

The graduating class was the largest in the history of the College, numbering sixty, with two additional who received in course the degree of master of science.

The names and addresses of those graduated are as follows:

Name.	Address.	County.
Armstrong, W. Clyde, m.	Hanover.	Jackson.
Barlow, Bronson, a.	Greenville.	Montcalm.
Barrett, Emma B., w.	Grand Haven.	Ottawa.
Barrows, W. Morton, a.	Agricultural College.	Ingham.
Blanchard, Charles M., m.	Chesaning.	Saginaw.
Brainard, Frank K., m.	Detroit.	Wayne.
Brown, Bliss S., a.	Monterey.	Allegan.
Brown, Willard M., m.	Lake Odessa.	Ionia.
Brown, W. Rutherford, m.	Lansing.	Ingham.
Buskirk, Beasie, w.	Wayland.	Allegan.
Carrell, William J., m.	Traverse City.	Grand Traverse.
Chase, Theron P., m.	Lansing.	Ingham.
Churchill, Jesse M., a.	Lansing.	Ingham.
Churchill, Omar O., a.	Lansing.	Ingham.
Dean, Olney J., m.	Colon.	St. Joseph.
Dey, Harry W., a.	Springport.	Jackson.
Digby, Adelbert C., a.	Rushton.	Livingston.
Drake, Leon L., a.	Stormer.	Benzie.
Eaton, Homer M., m.	Grand Rapids.	Kent.
Elmer, Ellsworth O., a.	Deveréaux.	Jackson.
Engel, Frederick, m.	Forestville.	Sanilac.
Fargo, Harvey D., m.	Lansing.	Ingham.
Foster, Floyd O., a.	Grand Rapids, R. F. D., No. 3.	Kent.
Fraser, John A., m.	Lansing.	Ingham.
Garthe, Stanley, m.	Northport.	Leelanau.
Gates, Seymour F., a.	Ionia.	Ionia.
Good, Edwin S., a.	Richfield.	Genesee.
Gunn, Katherine F., w.	Agricultural College.	Ingham.
Hadley, Alice, w.	Fenton.	Genesee.
Harrison, Edmund S., m.	Paw Paw.	Van Buren.
Hartman, Simon B., a.	Athens.	Calhoun.
Hedges, J. Harold, m.	Lansing.	Ingham.
Hesse, Burr T., a.	Napoleon.	Jackson.
Judson, Lowell B., a.	Lansing.	Ingham.
Lilly, Clyde A., m.	Allegan.	Allegan.
Longyear, Burton O., a.	Agricultural College.	Ingham.
Loop, James F., m.	Sparta.	Kent.
McClure, Samuel W., m.	Tecumseh.	Lenawee.
Marshall, Charles M., a.	West Branch.	Ogemaw.
Miller, Arthur C., a.	Vicksburg.	Kalamazoo.
Moore, James G., a.	Shepherd.	Isabella.
Morrison, Frank M., a.	Detroit.	Wayne.
Nacker, Owen M., m.	Agricultural College.	Ingham.
Nickie, Frank H., m.	Grand Ledge.	Eaton.
Norton, Horace W., Jr., a.	Howell.	Livingston.
Phillips, Frank J., a.	Grandville.	Kent.
Reimer, Frank C., a.	Baroda.	Berrien.
Rork, Frank C., m.	Lansing.	Ingham.
Sevey, Glenn C., a.	Ithaca.	Gratiot.
Severance, Howard D., m.	East Jordan.	Charlevoix.
Smith, Edna V., w.	Grand Rapids.	Kent.
Stevens, Frederick D., a.	Whitmore Lake.	Washtenaw.
Thomas, Ray G., a.	Three Oaks.	Berrien.
Thorne, J. Lane, a.	Lansing.	Ingham.
Tower, Ray R., a.	Belding.	Ionia.
Tryon, George, m.	Royalton.	Berrien.
Van Skiver, Ira J., m.	Sparta.	Kent.
Wheeler, Burr, m.	Grand Rapids.	Kent.
Wright, Hettie B., w.	Three Oaks.	Berrien.
Yates, Richard L., m.	Washington.	Macomb.
<i>M. S. Degree in course:</i>		
S. F. Edwards, '99.	Milan.	Washtenaw.
William Patton Snyder, '01, U. of Neb.	Eureka.	NEBRASKA.

Summary of enrollment during the past year.

Summary.	Agricul- tural.	Mechan- ical.	Wo- men's.	Totals.
Post-graduates	8		1	9
Class of '03.....	27	35	7	69
Class of '04.....	37	26	19	82
Class of '05.....	37	53	41	131
Class of '06.....	26	100	16	142
Sub-freshmen.....	58	95	43	196
Special students.....	26		60	86
Special short course students:				
B-et sugar.....	14			
Chrese.....	16			
Live stock.....	50			
Creamery.....	59			
Fruit.....	9			
	148			148
Totals	367	309	187	863
Deduct names repeated.....				9
Final total.....				854

Students entering during year, not including those in special short courses.

	Male.	Female.	Totals.
Number entering	251	98	349
Average age	18-10 $\frac{1}{4}$	19-1	.....
<i>Schools previously attended :</i>			
High school	193	72	265
District	24	11	35
College	32	15	47
Private	2	.....	2
<i>Entered college on :</i>			
High school diploma	96	38	134
Teacher's certificate	4	4	8
Standing from colleges	20	13	33
Examination	44	15	59
Age	20	7	27
Eighth grade diploma	66	21	86
<i>Support while here :</i>			
Father	130	68	198
Self	68	12	80
Parent and self	28	2	30
Mother	14	10	24
Not given	6	4	10
Guardian	1	.....	1
Other sources	4	2	6
<i>Occupation of father :</i>			
Clerk	3	3	6
Contractor	4	.....	4
Banker	2	.....	2
Deceased	10	9	19
Druggist	10	2	12
Farmer	89	31	120
Hotel keeper	1	.....	1
Lawyer	4	5	9
Lumberman	2	4	6
Manufacturer	3	1	4
Mechanic	13	2	15
Merchant	16	6	22
Mining business	1	.....	1
Minister	5	1	6
Miscellaneous	54	22	76
Not given	6	5	11
Physician	1	2	3
Real estate dealer	3	3	6
Teacher .....	.....	2	2
Traveling man	3	.....	3
Undertaker	3	.....	3
<i>Proposed occupation after leaving college :</i>			
Chemist	4	.....	4
Civil engineer	23	.....	23
Electrical engineer	18	.....	18
Farming	41	.....	41
Mechanical engineering	54	.....	54
Mechanic	21	.....	21
Miscellaneous	25	6	31
Not decided	20	18	38
Not given	42	51	93
Teaching	3	23	26

Church membership.

	Preference but not membership.	Member- ship.	Total.
Baptist.....	24	13	37
Catholic.....	2	5	7
Church of Christ.....	1	4	5
Christian Science.....	2	3	5
Congregational.....	56	20	76
Disciple.....	1	1	2
Dutch Reformed.....	1	1	2
Episcopal.....	8	5	13
Jewish.....		1	1
Lutheran.....	11	6	17
Methodist Episcopal.....	63	36	99
Methodist Protestant.....	10		10
No preference.....			36
Presbyterian.....	10	21	31
Union.....	2		2
United Brethren.....		1	1
Universalist.....	4	1	5

Counties represented in the entering class.

Allegan.....	12	Lapeer.....	9
Antrim.....	8	Leelanau.....	6
Arenac.....	2	Lenawee.....	4
Barry.....	2	Livingston.....	1
Bay.....	5	Mackinac.....	4
Benzie.....	4	Macomb.....	2
Berrien.....	9	Manistee.....	1
Branch.....	1	Marquette.....	2
Calhoun.....	5	Mason.....	1
Cass.....	3	Mecona.....	3
Charlevoix.....	4	Menominee.....	1
Cheboygan.....	1	Midland.....	1
Chippewa.....	1	Missaukee.....	2
Clinton.....	2	Monroe.....	5
Dickinson.....	1	Montcalm.....	2
Eaton.....	12	Muskegon.....	5
Emmet.....	2	Oakland.....	6
Genesee.....	7	Oceana.....	1
Gladwin.....	2	Ontonagon.....	6
Gogebic.....	1	Ottawa.....	6
Grand Traverse.....	4	Saginaw.....	6
Gratiot.....	6	Sanilac.....	1
Hillsdale.....	3	Schoolcraft.....	12
Huron.....	2	Shiawassee.....	2
Ingham.....	68	St. Joseph.....	1
Ionia.....	5	St. Clair.....	4
Iosco.....	1	Tuscola.....	4
Isabella.....	1	Van Buren.....	20
Jackson.....	11	Wayne.....	3
Kalamazoo.....	5	Wexford.....	
Kent.....	17		

Other States represented.

Florida.....	1	Pennsylvania.....	3
Illinois.....	2	Utah.....	1
Indiana.....	2	Vermont.....	1
New York.....	2	Wisconsin.....	2
Ohio.....	1	Nebraska.....	1

For further information, please consult the reports of the various departments of the College, as found in the following pages.

Respectfully submitted,

J. L. SNYDER.

Agricultural College, Mich.,
June 30, 1903.

REPORT OF THE DEPARTMENT OF PRACTICAL AGRICULTURE.

President Snyder:

The annual report of the Department of Practical Agriculture is herewith submitted. In September, 1902, I assumed the duties of the head of the Department of Practical Agriculture. In taking up any new work, it necessarily follows that some time must be spent studying the conditions before formulating any permanent method of procedure or attempting new work. During the College year, then about to begin, a large amount of time was given to lecture and demonstration work in annual husbandry. In this work the assistance rendered by Mr. George Humphrey, instructor in animal husbandry, was of great value, and we deeply regret his loss; but at the same time we are glad that such a wide field of usefulness has opened up to him as the newly appointed head of the Animal Husbandry Department of the University of Wisconsin. In addition to the direct demands of the department, seventeen addresses were delivered before farmers' and live stock organizations in various parts of the State.

To the course of instruction in animal husbandry one or two new features were added during the year. In the winter term a series of lectures dealing with the commercial side of the live stock industry was delivered to members of the senior class. In this work the following topics were discussed, viz: Domestic and foreign markets, influences affecting markets, transportation of live stock, the frozen meat trade, inspection of live animals, dressed meats, etc., quarantine regulations, and the effect of legislation in foreign countries in regard to the restriction of the American export trade.

In the spring term a series of lectures on animal nutrition was also given the seniors. There is perhaps no subject connected with the live stock industry which is deserving of more careful attention than this one.

Much difficulty was experienced during the fall term in teaching the subjects, study of breeds and stock judging. This was largely due to the fact that the various breeds of sheep were sadly lacking the infusion of fresh blood, youthfulness and vigor so necessary to present true breed type. There were no fat sheep to use for judging purposes. Only three breeds of swine were found, Duroc Jersey, Tamworth and Chester White and only one specimen of the latter. Representatives of a number of other breeds have since been added.

The only available animals for use in studying breed type and horse judging are the common work teams of the farm. No doubt various breeders of the State could be induced to furnish suitable specimens of a number of breeds to permit this work to be carried on satisfactorily. A number of other institutions are furnished with specimens in this way.

Plans have been made to give a series of demonstrations and instruction in meat cutting. We feel this to be a very necessary complement to the live stock judging work. In judging live animals only, the question of quality in the carcass remains largely a matter of speculation in the mind of the student. But if a number of animals can be judged on foot and the carcasses compared after slaughtering, much more good will be derived from the work.

During the fall and winter terms facilities were provided enabling students to carry out certain feeding experiments bearing on their instruction work. Fifty-one lambs were fed by students of the senior class, the primary object being to test various methods of feeding and combinations of food calculated to produce meat of good quality. Quality more specifically defined is here applied to carcasses possessed of depth and mellowness of flesh, rather than excessive fatness. After the feeding period was finished the lambs were slaughtered in the presence of the students, thus enabling them to judge as to the quality of the carcasses and secure data relative to the percentages of dressed meat, hide, loose tallow, offal, etc. The shrinkage resulting from storage of the carcasses during certain periods under different temperatures was also noted.

A number of carcasses were sent to dealers in Detroit, Grand Rapids, Lansing, Battle Creek, Adrian, Kalamazoo and Owosso, where the public was given opportunity to inspect them. The extent to which these students were successful in producing meat of prime quality is well expressed by the report of F. J. Dettenthaler of Grand Rapids, as follows: "Your shipment of lambs made us February 27th, arrived in most excellent condition. We take great pleasure in saying that they are by far the best fed stock we ever had. The meat in the rib and loin chop was extra thick with a large amount of lean meat, and the flavor more like spring lamb. If you can induce the Michigan sheep raisers to produce stock such as you shipped us it will be a great benefit to the State." These lambs were marketed making very creditable profits.

Experiments in swine feeding were also conducted during the spring term by junior and senior students. The object of this work was to determine the comparative results from feeding meal in the form of a slop versus meal with water supplied separately. Those receiving the moistened meal made a daily gain of 1.14 lbs. per capita per day while those receiving the dry feed gained but .86 lb. per capita in the same time. The percentages of dressed carcass were about the same in both cases, viz.: 79.65% and 79.89%.

A system of rigid selection and methodical feeding has been established in connection with the dairy herd and a number of the Holstein cows recorded in the "Advanced Registry." The effort in future will be to breed none but the best and make a careful study of economic production.

The pig breeding and feeding was confined almost solely to some cots and hog lots on a side hill near the river. The old hog house had been abandoned.

In December, 1902, the work of reconstructing the old piggery began. The building is 34x80 feet. The entire inner structure and old cement floor which was badly broken up, were both torn out. In relaying the floor a passageway 6 feet wide was put down through the center of the building, leaving fourteen feet on each side for pens; in this 14 feet from the passageway to the outside a fall of two inches was given in laying the cement. The reconstruction provides four pens 6½x14 feet; four pens 8½x14 feet; two pens 10x14 feet on one side and on the other seven pens 8x14 feet a feed room 14x16 feet and room for dipping 8x14 feet. Access to yards is being provided for each pen. Scales for weighing feed and pigs were set in the passageway near the feed room, which is in the center of the building. Both doors and ventilators are operated from the passageway. Swinging wooden front sections have been put in the pens to shut the pigs out of the trough while feeding. Over-lays constructed from cheap inch lumber were used during the winter to keep the young pigs from bedding down on the cold cement; these gave excellent satisfaction.

A large portion of the area lying between the piggery, river and poultry house has been refenced to provide grazing lots for pigs. In these soy beans, rape, succotash, rye, peas, sugar beets and permanent pasture are being grown. The purpose is to attempt to provide forage crops for the swine throughout as much of the year as possible. The new equipment, though still incomplete, is giving perfect satisfaction and will enable us to build up a good strong breeding and feeding establishment in which all the leading breeds are to be represented.

The fences adjacent to the farm buildings enclosing the lots used by cattle and swine, were badly in need of rebuilding. One hundred and ninety rods of this yard fencing has been replaced and somewhat rearranged with a view to greater convenience. Many of the farm fences will soon have to be replaced. Though apparently in fair condition, close examination reveals a large number of posts almost rotted off and the oldest woven wire so badly rusted that it cannot be used much longer.

Three yards have been constructed on the east side of the new dairy barn for bulls. These enclosures consist of tight board fence six feet in height. Hitherto the bulls housed in the dairy barn have not had access to yardage.

A large amount of grading has been done around the dairy barns. There being no natural drainage the yards were in bad condition during the entire winter and spring. The top of the hill lying between the barn and river has been removed and used to fill in between the gangway and the foreman's house where water accumulated. Eave troughs have also been placed on the dairy and grade herd barns with tile connection to remove the water. These changes have made the yards dry, useful and more sightly.

Considerable time has also been spent in repairing farm fences, grading roads, etc. A row of elms was planted last spring on the west side of the farm road between the Grand Trunk and Pere Marquette railroads.

Professor J. A. Jeffery was appointed Professor of Soil Physics and Agronomy early in the year and in this capacity has rendered valuable service, greatly enlarging the scope of his work.

From September 1st to March 1st Mr. A. E. Kocher very acceptably filled the position of Instructor in Agriculture, at which time he resigned to take up work with the Bureau of Soils at Washington. Since March 1st Mr. O. H. Skinner has done service as instructor. He however, will enter a sugar factory as chemist in the fall, which necessitates the securing of a new man as instructor.

The number of students given instruction in agronomy during the year just closing is about the same as that of a year ago. In addition three students have done graduate work.

The broadening of our course in agriculture will necessitate more crowding to make room for students and apparatus. To this end the old basement is to be cleaned up and converted more completely into laboratories for the study of soils and farm mechanics.

During the year the amount of time given to lecture and laboratory work by the Professor of Agronomy is as follows:

Fall term, four hours per day;

Winter term, four hours per day for eight weeks and five hours per day for four weeks;

Spring term, eight hours per day.

In much of this work the instructor's help was required. Nineteen talks have been delivered before farmers' institutes and one at a farmers' picnic.

In addition to the above there has been investigation work, and the routine work of directing the farm operations, etc.

The methods employed in practical agriculture continue to result in admirable crops which is pleasing to the department, and at the same time calls forth most favorable comment from the many parties visiting the farm.

The Dairy Division has been very successfully operated by Mr. John Michels, Instructor in Dairying. The scope of the work has been considerably enlarged during the past year. In addition to the regular instruction work, a number of investigations relative to certain phases of cheese and butter making have been conducted. Two educational scoring contests have also been inaugurated during the year, one for butter makers the other for the cheese makers of the State. In these tests samples of butter and cheese submitted by the makers for a series of six months is scored by experts. If any defects are found in the samples submitted, the attention of the maker is called to these by means of a score card and remedies are suggested. Judging by the expressions of opinion from various participants, these scoring contests have already proved valuable.

The instruction work has been conducted along lines similar to those previously followed. The following students have received instruction during the year, viz.:

- 33 Sophomores, Farm Dairying, for three weeks.
- 6 Seniors, Advanced Dairying, for one year.
- 58 Specials, Creamery work, for six weeks.
- 27 Specials, Farm Dairying, for two weeks.
- 15 Specials, Cheese Making, for four weeks.
- 54 Freshmen Sophomore Dairying, for five weeks.

193 Total.

The Instructor in Dairying delivered eight addresses before dairymen's gatherings in the State and furnished from one to two articles per week to local agricultural and dairy publications solely in the interests of the dairy industry of the State.

Respectfully submitted,
R. S. SHAW,
Professor of Agriculture.

HORTICULTURAL REPORT.

To the President:

With this report is concluded my first year in charge of the Department of Horticulture and Landscape Gardening. It is therefore fitting that an outline be given of the aims and purposes, the present status, and the needs of the department, as well as an account of the present year's work.

AIMS AND PURPOSES.

The chief aim—almost the sole aim—is to instruct students in horticulture by teaching. It is felt that instruction by experimentation, outside of that done by students at the College, belongs to the Experiment Station; and likewise that the dissemination of horticultural information belongs, for the most part, to the Experiment Station and Farmers' Institutes. The great aim of my department, then, is to teach students—to do college work. The teaching falls under two heads: that in the class-room and the illustrative and practical work in the laboratory and out of doors.

CLASS-ROOM WORK.

The following are the class-room courses now offered in the department and the number of students that have taken the courses this year: Plant Propagation in the Spring term of the Sophomore year, 72; Pomology in the Fall term of the Junior year, 45; Landscape Gardening in the Spring term of the Junior year, 45; Floriculture in the Winter term of the Junior year, 14; Spraying of Plants, Spring term of the Junior year, 12; Harvesting and Marketing, Fall term of the Senior year, 12; Evolution of Horticultural Plants, Winter term of the Senior year, 14; Experimental Horticulture, Spring term of the Senior year, 12. The

first three terms' work were required, the remaining courses were elective. Young women are required to take the course in Plant Propagation and a course, not mentioned above, in Floriculture and Landscape Gardening in the Fall term of the Junior year, in which there were 16 students.

LABORATORY WORK.

The laboratory courses, with the number of students in them during the year, are given below. Laboratory work takes the place of the old student labor, for which students were paid 10 cents per hour. In the Spring term of the Sophomore year the work consists of practice in grafting, budding, pruning, making cuttings, sowing and testing seeds, and in transplanting plants; number of students, 36. During the Fall term of the Junior year, a comparative study is made of the representative varieties of all the different orchard crops; number of students, 45. In the Winter term of the Junior year the work consists of practice in forcing vegetables and flowers in the greenhouses. During the Spring term of the Junior year practice is given in spraying and in making, testing, and analyzing spraying mixtures; 14 students in each of the last two courses. Students who desired paid labor found an opportunity for it on Saturdays, during vacations, and after hours on school days.

THE LABORATORY.

The laboratory—the first distinctively horticultural laboratory in the country—completed in 1889, was in a poor state of repair and unsuited to the needs of the department at the beginning of the year. Steps toward complete renovation were taken and began by the remodeling and re-furnishing of the main floor. The carpenter shop on this floor was removed to another building, and the room occupied by it was turned into a storage room for students' supplies. The old tool-room, 36 by 32 feet, occupying the choicest part of the building, in which the postoffice has been quartered for the past few years has been rebuilt and furnished with desks, drawers and lockers. The drawers have been equipped with saws, knives, shears, labels, markers, firmers, germinators, etc., whereby each student in the laboratory has an individual outfit. There yet remain the basement and the upper story to be refitted. In the basement it is recommended that the large room, now used for vegetables be turned into a laboratory room for the study of spraying mixtures and spraying implements, and that the smaller rooms for most part, be contributory to the main room. In the second story the class-room must be refurbished and three small rooms now used for storage purposes could well be refitted into a room for individual student work, a seed room and an herbarium room.

THE ORCHARD.

Few changes have been made during the past year in the orchards. The trees in the small peach and plum orchard west of the hospital were rapidly dying out and all were removed, and the land turned into campus. The orchards are in fair condition so far as the growth of trees is concerned. None are a success as to productiveness, as our land is not well adapted to orcharding, though all have yielded good results for experimentation and for student work. The following are the numbers

of the different kinds of fruits in the College and Station orchards: Apples, 600; Cherries, 100; Peaches, 45; Pears, 140; Plums, 100; Currants, 30; Gooseberries, 20; Grapes, 100; Raspberries, 50; Blackberries, 12; Strawberries, 200. A great number of these varieties are worthless, and having been thoroughly tested and reported upon, the plants should now be discarded.

THE GROUNDS.

No very important changes have been made in the grounds during the past year. Two new buildings, the Bacteriological Laboratory and the Bath House, have made necessary some grading, turfing, and building of walks. It has been found necessary, as in the past, to remove some trees and shrubs. Planting is always done to secure immediate effects and this means that at a later date the axe must be used to secure the welfare of the remaining plants, as well as to increase the beauty of the scenery. The springs of 1902 and 1903 have been wet and the grass and weeds have grown luxuriantly. With this increase of labor in caring for the grounds, and with the high price of labor, it has been impossible to do more than to keep the grounds in a normal condition with the money at my disposal, though opportunities for improvement are at hand. It has been thought best to do away with many of the flower beds formerly maintained on the lawns, both from the standpoint of beauty and from that of economy.

THE GREENHOUSES.

Early in the year the vegetable house belonging to the Station but under the charge of this department, was torn down and rebuilt as a part of the main greenhouse range. This was done as a matter of economy in heating, of convenience and because the old structure was in danger of tumbling down and had to be rebuilt. The old grapery, for the past few years falling into decay, has had to be torn down. So far as possible the greenhouses have been turned from exhibition purposes into houses for the illustration of class-room work and to give practice to students in growing flower and vegetable crops. The houses are now most admirably adapted for this purpose. During the session just past, flowers have been regularly supplied to the Legislature. These were grown by the students for the most part. The greenhouses and the student work connected with them have been under the charge of Mr. Thomas Gunson, to whom credit is due for the very great value of the houses and of the student work to the department.

THE VEGETABLE GARDEN.

The vegetable garden has been planted and cared for by students for most part as educational labor. It is carried on as a market garden, under the immediate supervision of Mr. Dean. The garden comprised about ten acres. To some extent the results are utilized by the Experiment Station. The intention of the department is to grow only as many, and only such vegetables as will illustrate the work for students and supply the Station with such tests as it may call for.

SPECIAL COURSES.

During the past winter the usual six weeks' course in Horticulture has been given and along the lines mentioned in previous reports. Nine students were enrolled, a slight increase over the previous year. Horticultural short courses do not commend themselves to fruit growers for the reason that it is absolutely impossible to teach horticulture in six weeks, and especially at a time of the year when work out of doors cannot be done. Probably better results could be secured by offering three distinct courses,—one in Pomology; one in Floriculture; and one in Vegetable Gardening. At present a smattering of all of these is given under the general head of horticulture.

SPRAYING THE ELMS.

A scale insect has been feeding on the campus elms for the past decade or more. A few trees have been killed by the depredators, many have been greatly injured and practically all somewhat injured. An appropriation was made by the State Board of Agriculture in November, 1902, of \$650 to check the scale. During March and April, 1903, the four hundred and eighty elms on the College grounds were sprayed with lime, salt and sulphur, as recommended by the Station Entomologist, Mr. Pettit. The results are very gratifying. All of the trees show the benefit of the treatment. On account of the rapidity with which the foliage came out in the early spring of this year, part of the trees in the elm avenue could not be sprayed on both sides. These trees should be re-sprayed next season.

THE HERBARIUM.

The department has started an herbarium for illustrative work in the class-room. The purpose is to obtain specimens of all the cultivated plants in the country. The work in the summer of 1902 was under the charge of Moses Craig, formerly professor of Botany in the Oregon Agricultural College. Under him a splendid start has been made. The collection now numbers over one thousand specimens.

THE RIVER BANK.

The river bank near the President's house has been caving badly during the past few years. To prevent such caving, forty piles have been driven. A retaining wall is being built against these piles which it is hoped will effectively provide against future caving.

THE HORTICULTURAL LIBRARY.

The department library, consisting of the T. T. Lyon collection of about 500 volumes, and of books purchased by the department, making nearly seven hundred in all, has been catalogued during the year and arranged for the convenience of students and members of the department teaching force.

HORTICULTURAL CLUB.

The students specializing in Horticulture have organized and maintain a horticultural club, which meets every other Wednesday night.

The club is proving a valuable adjunct to the class-room work. It is one of the first, if not the first, distinctively student horticultural club in this country. ,

ASSISTANTS.

Mr. Thomas Gunson, Mr. M. L. Dean, and Mr. H. Sherman have retained the positions filled by them in former years, and have ably performed their duties. In addition, Mr. B. Wermuth of the class of 1902, was paid from the department funds for assisting in the laboratory during the last six months of the year.

Now that the former labor period is given up to strictly educational work, students in the department need more supervision. Horticultural operations are carried on in the greenhouses, orchards, on the campus and in the laboratory. The supervisors must go from place to place, often leaving students without supervision for long periods. This is almost never satisfactory and a sufficient number of supervisors should be provided. It is reasonable to suppose that the value of the horticultural laboratory work is determined by the manner of its supervision. There is need of at least one more assistant for the coming year.

NON-HORTICULTURAL MATTERS.

The most burdensome and annoying work on the department at the present time is that which has nothing to do with teaching horticulture. I refer to the errand, the ice, the vegetable, the fuel, the scavenger, and the general utility work now imposed upon the department. The time was when the limited amount of this work necessary for the college community could be done by the department without much trouble, but the great growth of the community has changed this, and the non-horticultural and the non-professional work referred to above is now almost an intolerable nuisance. Relief could be given by assigning this work to some one person not having to do with the professional work of the College.

Very respectfully submitted,

U. P. HEDRICK,

Professor of Horticulture and Landscape Gardening.

Agricultural College, Mich.

June 30, 1903.

REPORT OF THE MECHANICAL DEPARTMENT.

To the President:

I have the honor of submitting the following report of the work done in the Mechanical Department during the year ending June 30th. 1903.

The work in the class rooms, drawing rooms, etc., has been conducted as follows:

FALL TERM.

Seniors.—Thermodynamics and Graphical Statistics of Mechanism by Prof. Weil. Steam Engine Design and Experimental Laboratory by Prof. Reynolds. Elementary Kinematics by Mr. Wells. Shop Practice by Mr. Leonard.

Juniors.—Machine Design by Mr. Wells. Shop Practice by Mr. Leonard. Metallurgy by Prof. Weil.

Sophomores.—Shop Methods by Mr. Leonard. Shop Practice by Messrs. Leonard, Theodore and Baker.

Freshmen.—Shop Practice by Mr. Krentel and Mr. Baker.

Sub-Freshmen.—Visits of Inspection by Mr. Wells.

WINTER TERM.

Seniors.—Advanced Kinematics by Prof. Weil. Steam Engineering Laboratory by Prof. Weil and Prof. Reynolds. Advanced Machine Design by Mr. Leonard.

Juniors.—Machine Design and Steam Engine Design by Mr. Wells. Valve Gears and Boilers by Prof. Reynolds. Shop Practice by Mr. Leonard and Mr. Theodore.

Sophomores.—Elements of Machine Design by Mr. Wells. Shop Practice by Messrs. Leonard, Theodore and Baker.

Freshmen.—Shop Practice by Mr. Bradford and Mr. Baker.

Agricultural Freshmen.—Shop Practice by Messrs. Theodore, Krentel and Baker.

SPRING TERM.

Seniors.—Engineering Practice by Prof. Weil. Thesis Work by Prof. Weil and Prof. Reynolds. Original Design by Mr. Leonard.

Juniors.—Strength of Materials by Mr. Wells. Testing Materials of Engineering by Prof. Reynolds. Shop Practice by Mr. Leonard and Mr. Theodore.

Sophomores.—Elements of Machine Design by Mr. Wells. Elements of Steam Engine by Prof. Reynolds. Shop Practice by Messrs. Leonard, Theodore and Baker.

Freshmen.—Shop Practice by Mr. Krentel and Mr. Baker.

At the close of the College year, Mr. H. W. Reynolds, who was senior instructor in this department, was promoted to the position of assistant professor of mechanical engineering. Mr. W. R. Bradford, instructor in wood shop resigned his position to take charge of the work of manual training in the schools at Calumet, Michigan. Mr. Bradford carried on

his work with marked success, and his resignation was received with regret.

Mr. Andrew P. Krentel has been appointed instructor in the wood shop.

The work of this department has been carried on during the past year, in general, with regards to additions, repairs, etc., etc., along the lines indicated in previous reports.

In our report for the year ending 1902 the authorization by the Board of Agriculture of the construction of a new engineering building was noted. At the present time the department is sorely in need of additional room, and we trust that the building referred to may be erected in the near future.

During the year, as in past years, the writer has carried on considerable engineering work for the College. The most important engineering undertaking of the year has been the laying of a new system of mains, which work is now in progress.

Respectfully submitted,

CHAS. L. WEIL,

Professor of Mechanical Engineering.

Agricultural College, Michigan.

June 30th, 1903.

REPORT OF WOMEN'S DEPARTMENT.

President J. L. Snyder:

Permit me to submit the report of the Women's Department for the year just closed.

The year's trial of the five-year course has justified the hopes with which it was inaugurated. The work of all the teachers has been increased, however, by the increased number of students. In the fall and winter terms every available place in the Women's Building was used, but during this crowded period the students were mutually helpful and generous. The housing of the women students has come to be a rather serious question.

Mrs. Haner, with the able assistance of Mrs. Gingles, has carried on the work in domestic art practically as last year. After six years of faithful service Mrs. Haner has been granted a year's leave of absence for advanced study in her specialties, sewing and wood-work. Mrs. Gingles, who has been a very helpful member of the department and of the College family, will have charge of the domestic art work during her absence.

In domestic science, the department was fortunate to retain Miss Lyford, who assumed, in addition to the advanced class work, the duties of Club Steward, and has shown herself thoroughly efficient in this line of work. Miss Jennette C. Carpenter, B. S., of the class of '98, the new instructor in Cookery has proven an excellent worker and a valued addition to the department.

The resignation of Mrs. C. E. Marshall, whose musical ability and thorough work have been recognized for years past, made necessary the appointment of a new instructor in music. Miss Louise Freyhofer, B. S., just returned from two years' study in Germany, was secured and her work has been most satisfactory in every way. We consider ourselves favored to retain her in charge of this work.

Physical training, under Miss Avery's able direction, has been carried on in two sections throughout the year, thus making special and more advanced work possible.

Mrs. Barber has given again the lectures in home nursing and we hope this may be a permanent arrangement.

The Dean has carried, in addition to the Freshmen Ethics, a spring term senior elective,—the History and Philosophy of Education,—and has found it a most interesting means of contact with the senior women.

Respectfully submitted,

MAUDE GILCHRIST,

June 30, 1903.

Dean of Women's Department.

REPORT OF DEPARTMENT OF BACTERIOLOGY AND HYGIENE.

President J. L. Snyder:

I have to report that this has been the most unsatisfactory year of teaching during my connection with this College. All of us in this department feel that we have not satisfactorily accomplished what we should have accomplished in instruction, and further feel under obligation to those students who have subjected themselves to so many inconveniences. The reason for this lies in the fact that owing to the disturbed condition of the old laboratory and its filling up with supplies which were to be placed in the new laboratory, we were not able to conduct any laboratory work until the winter term.

Two weeks after the beginning of the winter term, we entered the second floor of the new laboratory. With this we began operations but were constantly interfered with by carpenters and plumbers who were finishing various parts of the building, making connections of pipes and flues; frequently the water or gas would be shut off for hours at a time and we could do nothing. This continued throughout the winter term. Taking it all in all we have been working under many difficulties.

Although our work has suffered greatly this year, nevertheless we are grateful to know that with the opening of the new school year we shall be able to occupy the new laboratory, so kindly and generously granted by the Board of Agriculture, and trust that we shall not only be able to do the work that we have heretofore been doing, but to make the work more useful to the students. It is our aim to apply bacteriological facts to the everyday pursuits of those following specific lines of agricultural work, domestic science work, or other industrial pursuits.

In closing I wish to acknowledge the efficient assistance of Mr. S. F. Edwards and Mr. B. Barlow in their capacity as instructors.

Most respectfully submitted,

CHARLES E. MARSHALL,

June 30, 1903.

Professor of Bacteriology and Hygiene.

REPORT OF THE DEPARTMENT OF BOTANY.

President J. L. Snyder:

I have the honor to hand you my brief report for the year ending June 30, 1903.

During the past year students have received instruction in this department as shown in the table below:

Class.	Subject.	Term.	Hours per week.	Students enrolled.
Resident graduate.....	Three subjects.....	Three terms.....	.....	1
Seniors.....	Wood technology.....	Winter.....	4	2
Juniors.....	.....	.....	4	3
Juniors.....	Plant physiology.....	Spring.....	3	3
Agricultural juniors.....	Parasitic fungi.....	Fall.....	9	31
.....	Grasses and other forage plants.....	Winter, five weeks.....	5	30
.....	Weeds.....	.....	5	20
.....	Plant ecology.....	Spring.....	3	37
Agricultural sophmores.....	Trees and shrubs.....	.....	2½	34
Women sophmores.....	Plant histology.....	Winter.....	9	30
.....	.....	Spring.....	7	36
Agricultural freshmen.....	Trees and shrubs.....	.....	2½	40
Women freshmen.....	Fruits and seeds.....	Fall.....	4½	16
Agricultural freshmen.....	.....	.....	4½	25
Women freshmen.....	Systematic botany.....	Spring.....	3	18
Agricultural sub-freshmen.....	Plant histology.....	.....	7	22
Women sub-freshmen.....	Beginning botany.....	Fall.....	3	59
Agricultural sub-freshmen.....	.....	.....	3	49
Women sub-freshmen.....	Systematic botany.....	Spring.....	2	44
Agricultural sub-freshmen.....	.....	.....	2	35
Women sub-freshmen.....	Live stock.....	Winter.....	5	48
Specials.....	Fruit culture.....	.....	5	10
.....	Sugar beet.....	Spring.....	10	13
Total students enrolled.....				587

As you may know, these students were taught by two men and half the time of another, the same force that served at the College seven years ago when there was not half as much teaching as at present. This has been accomplished by enlarging the classes and in a number of instances by shortening the time for each class. As much of the teaching is in the line of laboratory work, a shortening of the hours for work and the increase in number of students per class materially affects the thoroughness of the instruction,—a result which I very much regret. Although the teaching force had enough to do, I should have divided some of these classes, had it been possible to avoid conflicts in the schedule.

Please do not forget that both the professors of Agriculture and the professor of Horticulture unite with me in thinking it best that all Agricultural seniors should have at least one term of instruction in Plant Physiology during their course, and that we are omitting this work for lack of suitable rooms. I have for ten years given up the use of most of a laboratory planned for my own use and given the space over to my

assistants and to students. I have no private laboratory in which to carry on investigations. Excepting one week of the last long vacation, I remained here at work or was engaged in making collections and taking photographs for the College. Long hours were occupied in putting to rights our large herbarium and in arranging our numerous negatives, slides and photographs and in labeling and otherwise improving the botanic garden.

I now expect to work here during the present long vacation and in making collections and observations for the advancement of the department. The garden has been much improved.

I am sorry to tell you that as the students increase in numbers and more people visit the College, depredations of one kind and another have become more frequent. There seems to be a necessity for policing the garden, especially in the evening and on Sundays, when the gardener is absent.

In looking over the past I cannot help regretting that eleven years of my time here were divided between horticulture and botany, and a still longer time was divided between forestry and botany.

THE HERBARIUM.

The additions made during the past year are enumerated below:

SEED PLANTS, FERNS AND THEIR ALLIES.

C. H. Peck, State Botanist of N. Y., Cones of <i>Picea rubens</i> , three lots	3
B. L. Robinson, Harvard University, <i>Plantae Excicatae Grayanae</i>	100
Gerald Cheney, Alabama	11
B. Barlow, Collection of 1901 in Upper Peninsula	48
C. J. Davis, University of Michigan, <i>Hybrids Oaks</i>	4
C. D. McLouth, Muskegon	44
Almon N. Rood, Phalanx, Ohio	35
Mrs. R. Mann, Ferns and allies, <i>desiderata</i>	14
Willard Clute, Binghampton, N. Y.	14
W. A. Cannon, from southeast U. S.	221
S. M. Tracy, Gulf Coast plants	546
A. A. Eaton, <i>desiderata</i>	38
Home Collections	537
	<hr/>
	1,615

MOSSES AND LIVERWORTS.

E. G. Britton, for Columbia University, N. Y. Mosses	50
W. A. Cannon	17
	<hr/>
	67

LICHENS.

W. A. Cannon	6
Clara E. Cummings	40
	<hr/>
	46

FUNGI.

W. A. Kellerman, Ohio, Fascicles IV, V, VI.....	60
Collection of the late G. H. Hicks.....	174
Fungi Columbiani	1,800
Arthur and Holway Exsiccatae et Icones, Fascicle IV.....	50
Home Collections	274
W. A. Cannon.....	3
	<hr/> 2,161

ALGAE.

Collins, Holden, and Setchel, Fascicles C.....	25
Collins, Holden, and Setchel, Fascicles XIX, XX, XXI.....	150
	<hr/> 175

Total additions for the year..... 4,064

GENERAL SUMMARY OF PLANTS IN THE HERBARIUM.

Seed Plants (Spermatophyta).....	63,739
Ferns and their allies (Pteridophyta).....	1,224
Mosses and Liverworts.....	1,954
Lichens	1,181
Fungi	15,350
Algae	1,870

Total number in the Herbarium..... 85,318

DONATIONS TO THE BOTANICAL DEPARTMENT.

From S. Alexander, Birmingham, Mich., specimens of leaves, fruit and timber of *Quercus Alenanderi*.

From C. D. McLouth, seeds of *Salsola Tragus*.

From C. H. Peck, State Botanist, Albany N. Y., 3 packages *Picea rubens* Sarg.

From Prof. H. L. Clark, Olivet, Mich., *Euphorbia pepulus*.

From Gray Herbarium of Harvard University, 100 *Plantae Exsiccatae Grayanae*.

From C. F. Wheeler, Washington, D. C., 1 *Opuntia*.

From G. M. Park, 81 packages of seeds; 6 kinds of bulbs.

GIFTS TO OTHERS.

To C. S. Sargent, Arnold Arboretum, 14 lots of *Crataegus*.

To Bureau of Plant Industry, 92 herb. specimens of woody plants.

U. S. Department Agriculture, 150 herbarium specimens.

To Gray Herbarium of Harvard University, 200 herbarium specimens.

To New York Botanical Garden, 200 herbarium specimens.

To Superintendent of Parks and Boulevards, Detroit, Mich., 4 living shrubs.

To Bureau of Forestry, 60 forest views, unmounted.

To State Forestry Commission, Lansing, Mich., 63 photographs.

To State Normal College, 8 Aquatic Plants.

To seed Laboratory and Bureau of Plant Industry (F. H. Hillman), 27 lots of seeds of weeds.

Thanks are tendered Professor J. B. Dandeno and Instructor B. O. Longyear for faithful services during the past year.

W. J. BEAL,
Professor of Botany.

Agricultural College, Mich.
June 30, 1903.

REPORT OF FORESTRY DEPARTMENT.

To the President:

I have the honor to submit herewith the first annual report of the Department of Forestry for the year ending June 30, 1903.

My connection with the Michigan Agricultural College began September 1, 1902. On that day I studied the attempt that nature is making to restock the cut-over areas around Grayling, Crawford County. The next day the acre plantation of trees belonging to the Experiment Station at that place was studied. Of the 50 species of native and foreign trees planted there by the Botanical Department in 1888, the native White and Norway Pine give the best promise of success. Many of them are now 14 to 16 feet high and thrifty. On the same piece of 80 acres is abundant opportunity for further trial and such should be made as soon as possible.

On November 17, 1902, the State Board of Agriculture placed in the hands of the Professor of Forestry the woodlots and wood lands belonging to the College. At the same time with the approval of the Director of the Experiment Station three acres, a portion of field number six, were set aside to be used as a forest nursery making a total of nearly 200 acres under the charge of this department or nearly one-third of the whole farm. The remaining areas aside from the forestry nursery plot have been sufficiently described in the report of the State Board for 1895, page 35.

At the time of my arrival the pinetum was in a flourishing condition making a height growth of from two to three feet the sixth year after planting. A small plantation of deciduous and evergreen trees north of the pinetum had been started in the spring of 1902 under unfavorable soil conditions. Nevertheless, it was doing fairly well. This has since been improved and some of the small trees replaced with more valuable sorts. All the valuable timber was removed from the farm some 10 or 15 years ago so that only fuel material is left. Many of the beech and maple trees that had been left had been marked for cutting into fuel.

It is desired to convert the piece of 55.5 acres back of field number seven into an arboretum as fast as practicable. Planting with this object in view has already begun. Some improvement cuttings have been made in this piece.

On the south side of field number 17 improvement cuttings have also been made. Acorns, bittersnuts, two quarts of locust seed, and 100 young basswood trees 36 inches high have been planted where the trees were taken out. On May 18 fire ran over about five acres of this piece and beside burning three cords of 36-inch wood and doing other damage probably destroyed a part of the planting. A few hundred locust trees 18 inches high were planted on part of the area burned over.

The scattering trees that stood on the west end of field 19 have been cut into wood. The wood has sold at varying prices depending upon the quality, length and delivery as follows:

Two hundred seventy-six cords 16-inch at \$2.00; 9½ cords 16-inch at \$1.75; 1 cord 16-inch at \$1.60; 3¼ cords 16-inch at \$1.50; 21¾ cords 36-inch at \$2.50; 6¼ cords 36-inch at \$2.25; ¾ cord 36-inch at \$1.75; 1½ cords 36-inch at \$1.50; 1½ cords 36-inch at \$1.10, not delivered; 2½ cords 36-inch at \$1.00, not delivered.

Sixty cents per cord was paid for cutting 16-inch and seventy cents for 36-inch. The 16-inch sold so much more readily that only 77½ cords of 36-inch were cut. It cost from 40 to 50 cents per cord to deliver the 16-inch and 70 to 80 cents to deliver the 36-inch. This leaves a net stumpage value of from 90 cents to \$1.00 per cord for most of the 16-inch and of from \$1.00 to \$1.10 for most of the 36-inch. A few trees were so badly decayed that they little more than paid for getting out if present returns only are considered but to let them stand or leave them on the ground would have been poor management, for if left standing they would be a hindrance to the growing trees and if left on the ground would help to increase damage from fire. During the winter the team and driver from the Experiment Station was permitted to haul wood at 25 cents per hour but when the open season began it was necessary to pay 35 cents per hour for man and team.

During December and January the weight of 81.5 cords of 16-inch wood was taken and the average weight per cord (mostly beech) was 1,832 pounds. The average weight of four cords of top 36-inch beech was 2,882 pounds. The 16-inch wood sold readily for two dollars per cord delivered and the 36-inch went slowly at two dollars and fifty cents per cord. By reducing to rate per ton we find that the 16-inch cost \$2.18 per ton and the 36-inch \$1.73 per ton. If we add to the price of the 36-inch 75 cents for cutting each stick twice to make it convenient stove length we find it cost \$2.48 per ton or thirty cents more per ton than the 16-inch. Later orders were given to cut nothing over 16 inches. In this length the limbs are used up closer, and more profit is realized per tree.

With the cooperation of the Chemical Department a test was made to determine the heat value of different parts of beech and maple trees. The results were as follows:

Results of determination of heat units in beech and hard maple wood taken from different parts of the tree.

Sample No.	Position.	Per cent moisture.	Per cent dry matter.	B. T. U. per lb., original wood.	B. T. U. per lb., dried wood.
2	Beech heart, near stump.....	25.3	74.7	7,258.0	9,718.5
7	Maple sap, near top.....	30.8	69.2	6,099.1	8,813.3
4	Beech limb, two inches in diameter.....	35.2	63.8	5,888.4	9,227.1
6	Maple heart, near stump.....	32.8	67.2	5,870.8	8,785.8
8	Maple limb, two inches in diameter.....	35.7	64.3	5,817.2	9,045.8
5	Maple sap, near stump.....	26.1	73.9	5,581.9	8,735.8
1	Beech sap, near stump.....	40.2	59.8	5,534.4	9,258.5
3	Beech sap, near top.....	44.1	55.9	5,068.6	9,098.5

Arranged according to the British Thermal Units per pound of original wood as taken from the pile. Wood cut in January a few days before samples were taken.

The samples for test were procured by cutting dust with a fine saw from the sample of wood.

This spring 3,000 locust trees have been planted. Part of them north of the pinetum, part on the west end of field 18 and the remainder in the south part of field 17; 3,000 catalpa have been planted alternating with the locust except that none were planted in 17; 500 European larch and 500 Norway spruce have been planted in suitable places; 100 basswood have been planted in open places on the south end of field 17. About 200 white ash, white pine, Norway spruce and others have been planted in the woods back of number 7 making a total of 7,300 trees that have been planted this spring.

Seed planting in the nursery began April 29th. The seeds of conifers were sown broadcast in beds four feet wide. The aim was to have about 100 seeds germinate per square foot. Since the seeds have germinated we find them rather thicker than that. It is expected to transplant large numbers of these as soon as they get large enough to handle. The beds after sowing were covered with two or three inches of leaves and on part of these were placed lath screens and on part brush and on part nothing was placed to hold the leaves in place. The lath screens were made four feet square with the space of a lath between each two. For end pieces a lath on either side was used. These are light and very easy to handle. As soon as the pine seeds had begun to germinate the screens and leaves were removed and the screens supported on poles resting on stakes about 14 inches above the ground. On part of the beds in place of the screens brush from trees that were cut for wood during the winter was used. The screens are much more expensive, costing about 13 cents each, to begin with but they are far superior in management as they can be removed and replaced with but little loss of time and permit of easy access to any part of the plantation while the brush are troublesome to handle and obstruct the paths between the beds. The leaves on the beds gave ideal conditions for seed germination and as a consequence the per cent of germination has exceeded expectations. Seeds of deciduous trees were planted in rows 3½ feet apart for horse cultivation. The locust seeds were placed in water drawn from the steam boiler using about two quarts of hot water to a pound of seed. They were

stirred for half an hour at intervals of about five minutes and then allowed to stand from the afternoon of one day to the forenoon of the next when nearly every seed had swollen. Planting was begun and continued until the next day when the radicles began to show on some of the seeds. The ground was dry so the row was wet from the spout of a watering can, the seeds distributed from the hand and covered. Catalpa and white ash seeds were placed in warm water for a short time before planting. The white ash shows poor germination but there will be plants enough to fill the rows. The locust come up unevenly. The catalpas show a high per cent of germination and stand thick in the row so that a good deal of thinning will be necessary. Some of the other seed planted have not germinated yet. The most of the seed was of those species that we know to be of most economic importance. The following list gives the name and amount of seed in ounces of each species planted: amabilis fir, 1; balsam fir, 1; white fir, 1; lowland fir, 1; red fir, 1; Sitka spruce, 1; noble fir, 1; black hemlock, 1; sub-alpine fir, 1; Fraser fir, 1; Lawson's cypress, 1; white cedar, 1; western juniper, 1; red cedar, 64; incense cedar, 1; white spruce, 1; Engleman's spruce, 1; Colorado blue spruce, 1; foxtail pine, 1; shore pine, 1; Coulter pine, 1; limber pine, 1; Jeffry pine, 1; sugar pine, 1; silver pine, 1; California swamp pine, 1; lodge-pole pine, 16; bull pine, 16; Norway pine, 64; pitch pine, 1; white pine, 64; Douglas spruce, 16; giant tree of California, $\frac{1}{2}$; red wood, $\frac{1}{2}$; bald cypress, 16; hardy western catalpa, 80; white ash, 48; locust, 64; basswood, 64; black cherry, 64. A few seeds of each were preserved as specimens.

Calculating from the number of seeds per ounce of each species we find that nearly one million seeds have been planted.

In cooperation with the entomological department of the Experiment Station the woods back of field 7 have been improved by drainage. Sewer pipes have been put in at road crossings where necessary. Drain tile have been laid along the road that runs between the pinetum and the woods so that the places on either side of the road that were originally swampy are now dry.

The rail fence on the west end of field 18 was moved 40 paces to the east and about three fourths of an acre of pasture planted to locust and catalpa in alternating rows four feet apart. This is in the way of an experiment to see if trees can be grown without plowing the pasture sod. Some furrows for fire protection will probably be necessary.

During the fall term a class of six young men was instructed in the elements of forestry and forest botany. The class was made up of three seniors and three juniors. In the winter term five of these continued in the same subjects and a class of 31 juniors in agriculture were instructed in the elements of forestry. This spring term a class of six, two seniors and three juniors and one special, has been instructed in silviculture and a class of three juniors have received a special course in forest botany making a total enrollment of 37 different students under the instruction of this department.

A beginning has been made toward the collection of normal and abnormal growths and forest products. The following donations to the department have been made:

Two bushels of Norway pine cones and a section of hemlock log, Salling-Hanson, Grayling, Mich.

Four-foot log rule and pickeroon, Botanical Department, M. A. C.

Specimen of longleaf pine from Georgia, Prof C. D. Smith.

Thirteen pin oak, 3 feet high, Detroit Park Commission, per S. Alexander.

Specimen of Toothache tree, loblolly pine, cones and young plants of longleaf pine and Indian bread from Texas; tie lifter, pickeroon, ax pickeroon, peeler, double-bit ax, broad ax and skidding-dogs from Montana; 67 mounted specimens of trees and shrubs from M. A. C. campus, G. E. Tower, Bureau of Forestry, Washington, D. C.

Eight samples of distillation products, Cleveland Cliff Iron Company, Munising, Mich.

My own collection of specimens of forest trees and shrubs has been made available for the use of the department. It is very desirable to increase these collections to be used for purposes of illustration and to have a suitable place for their exhibition.

A paper on "Methods of Reforesting the Cut-over Lands of Southern Michigan" was presented at the Farmers' Institute Roundup at Owosso. A paper on "Some Forestry Requirements" was prepared for the annual report of the State Forestry Commission.

Respectfully submitted,

E. E. BOGUE,
Professor of Forestry.

June 30, 1903.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND CIVIL ENGINEERING.

To the President:

As in earlier years, the records of the year past must include much that should be viewed as work well done, as well as some things tending less to satisfaction. Notwithstanding a general spirit of industry and effort shown by the student body in as full measure as in other years, the percentage of successful results in class work has been lower. This is probably due in part to the manifold requirements of the teaching schedule and the large classes in some subjects, which leave very little time for attention to the individual student.

By far the larger number of failures occur in the sub-freshman and freshman classes. This would indicate the advisability of attention to the better preparation of those who intend to become students at the college.

With the close of this year we have completed for the first time the series of classes in civil engineering subjects which were first offered and begun in the fall of 1901. Fifteen seniors successfully completed the work in these optional studies and fourteen of the young men were graduated with their class on commencement day, June 18, 1903. The general pleasure in the work expressed by these pioneers, and their success in obtaining positions would argue the value of the course, its efficiency and the propriety of its continuance and development.

INSTRUCTION.

We began the year with only three of the old teaching force, Assistant Professor W. Babcock, Instructor A. H. Parrott and the writer. Besides these, two others were engaged during the summer of 1902 and remained with us during the year, namely Mr. L. A. Waterbury, Instructor in Mathematics and Civil Engineering, and Mr. L. F. Harza, Instructor in Mathematics. It was hoped that with five teachers we should be able to meet the requirements of the teaching schedule, but with the advent of a very large entering class in the fall of 1902 it was at once evident that another assistant was needed. Accordingly Mr. W. A. Gardner was engaged as Instructor in Mathematics and served in that capacity from October 3, 1902, to the end of the year.

Of the six teachers named above, three have resigned to take other positions at the end of the school year, leaving us with a problem of re-organization even more serious than last fall. Those who leave are Instructors Parrott, Waterbury and Gardner. It is to be regretted that funds are not available to enable us to retain tried teachers against the competition of other institutions.

The following text-books have been used in our classes during the year: Beman & Smith's Higher Arithmetic for classes in mensuration; Wells' Essentials of Algebra by the women and agricultural students; Hall & Knight's College Algebra (Sevenoak's revision) by mechanical students; Wentworth's Geometry by women and agricultural students; Wells' Geometry by mechanical students; Jones' Trigonometry; Tanner & Allen's Analytic Geometry; Taylor's Calculus; Hodgman's Surveying; Johnson's Surveying for all classes in higher surveying; Church's Mechanics; Merriman & Jacoby's Graphic Statics; Merriman & Jacoby's Bridge Stresses; Merriman & Jacoby's Bridge Design; Nagle's Field Manual for Railroad Engineers; Baker's Masonry Construction; Murray's Differential Equations.

The tabulation below exhibits in detail the class work of the department, the various assignments of instructors and other items necessary to a complete record.

Class work of the department of mathematics and civil engineering for the college year 1902-03.

Class.	Subject.	Number of course.	Teacher.	Class room.	Hour of meeting.	No. of hours per week.	No. of students in class.
Fall term:							
Sub-freshmen.	M. algebra.....	Math. 1c....	Mr. Waterbury	Abbot hall.....	8-9	5	37
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	9-10	5	26
"	" " " " " " " "	" " " " " " " "	Mr. Gardner....	Dairy " " " " " "	8-9	5	25
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	9-10	5	26
"	Ag. & W. algebra.	" 1.....	Mr. Harza.....	" " " " " " " "	8-9	5	27
"	Ag. & W. " " " "	" 1.....	" " " " " " " "	" " " " " " " "	9-10	5	25
"	Ag. & W. " " " "	" 1.....	Mr. Gardner....	8, College hall.	10-11	5	33
"	Ag. & W. " " " "	" 1.....	" " " " " " " "	" " " " " " " "	11-12	5	14
Freshmen.....	Ag. algebra.....	" 1b....	Mr. Harza.....	8, " " " " " "	3-4	5	18
"	W. " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	3-4	5	24
"	M. " " " " " "	" 1e....	Prof. Babcock.	6, " " " " " "	1-2	5	21
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	10-11	5	35
"	" " " " " " " "	" " " " " " " "	Mr. Parrott....	6, " " " " " "	2-3	5	32
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	10-11	5	20
"	" geometry.....	Math. 2d....	Mr. Waterbury	Abbot hall.....	1-2	5	21
"	" " " " " " " "	" " " " " " " "	Gardner....	8, College hall.	1-2	5	21
"	" " " " " " " "	" " " " " " " "	Harza.....	Abbot hall.....	1-2	5	29
"	" " " " " " " "	" " " " " " " "	Parrott....	8, College hall.	8-9	5	24
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	11-12	5	34
Sophomore....	Ag. " " " " " "	" 2b....	Prof. Babcock.	Abbot hall.....	9-10	5	21
"	" " " " " " " "	" " " " " " " "	Mr. Harza.....	6, College hall.	10-11	5	16
"	Analytic geom....	Math. 5.....	Prof. Babcock.	Dairy " " " " " "	10-11	5	16
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	6, College hall.	8-9	5	32
"	" " " " " " " "	" 5.....	Mr. Parrott....	8, " " " " " "	9-10	5	28
Junior.....	Mech. of eng.....	" 7a....	Prof. Babcock.	6, " " " " " "	11-13	5	16
"	Surveying (class).	Civil eng. 1b	Mr. Waterbury	2, " " " " " "	11-12	5	16
"	" " (field)...	" " " " " " " "	Prof. Vedder..	2, " " " " " "	10-11	2	33
"	" " " " " " " "	" " " " " " " "	{ Prof. Vedder & }	" " " " " " " "	1-3	2	18
"	" " " " " " " "	" " " " " " " "	{ Mr. Waterbury }	" " " " " " " "	1-3	2	15
Senior.....	Ag. C. E. (class)..	" 2.....	Prof. Vedder..	2, College hall.	9-10	5	8
"	" " (field)...	" 2.....	" " " " " " " "	" " " " " " " "	1-3	2	8
"	Graphics.....	Civil eng. 4.	" " " " " " " "	2, College hall.	8-9	3	31
"	R. R. surveying....	" " 7.	Mr. Waterbury	2, " " " " " "	1-4	6	18
"	Bridge stresses...	" 8a....	Prof. Vedder..	2, " " " " " "	10-11	3	17
Totals.....	32 sections.....					145	738
Winter term:							
Sub-freshmen.	Ag. & W. algebra.	Math. 1a....	Mr. Harza.....	8, College hall.	8-9	5	12
"	Ag. & W. " " " "	" " " " " " " "	" " " " " " " "	8, " " " " " "	9-10	5	20
"	Ag. & W. " " " "	" " " " " " " "	Mr. Gardner....	8, " " " " " "	10-11	5	32
"	Ag. & W. " " " "	" " " " " " " "	" " " " " " " "	8, " " " " " "	11-12	5	19
"	Mech. algebra.....	Math. 1d....	" " " " " " " "	Abbot hall.....	2-3	5	20
"	" " " " " " " "	" " " " " " " "	Mr. Harza.....	8, College hall.	2-3	5	21
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	Dairy " " " " " "	10-11	5	24
Freshmen.....	Ag. geometry....	Math. 2b....	Mr. Waterbury	" " " " " " " "	10-11	5	23
"	W. " " " " " "	" " " " " " " "	Mr. Gardner....	6, College hall.	9-10	5	19
"	M. algebra.....	" 1f....	Prof. Babcock.	6, " " " " " "	2-3	5	20
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	6, " " " " " "	11-12	5	27
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	6, " " " " " "	1-2	5	14
"	" " " " " " " "	" " " " " " " "	Mr. Parrott....	Abbot hall.....	11-12	5	28
"	" " " " " " " "	" " " " " " " "	" " " " " " " "	" " " " " " " "	1-2	5	15
Sophomore....	M. Dif. calculus...	Math. 6a....	Prof. Babcock.	6, College hall.	10-11	5	27
"	" " " " " " " "	" " " " " " " "	Mr. Parrott....	Abbot hall.....	10-11	5	25
Junior.....	Mech. of eng.....	" 7b....	Prof. Babcock.	6, College hall.	8-9	5	14
"	" " " " " " " "	" " " " " " " "	Mr. Waterbury	Abbot hall.....	8-9	5	15
Senior.....	Ag. engineering....	Civil eng. 3.	Prof. Vedder..	2, College hall.	10-11	5	8
"	Hydraulics (class)	" " 5.	Mr. Waterbury	2, " " " " " "	11-12	5	18
"	" " (lab).....	" " 5.	" " " " " " " "	2, " " " " " "	1-3	4	18
"	Bridge analytics and design.....	" " 8b	Prof. Vedder..	2, " " " " " "	8-10	8	16
Totals.....	22 sections.....					112	435

Class work.—Concluded.

Class.	Subject.	Number of course.	Teacher.	Class room.	Hour of meeting.	No. of hours per week.	No. of students in class.
<i>Spring term:</i>							
Sub-freshmen.	Ag. and W. geom.	Math. 2a....	Mr. Gardner....	8, College hall.	8-9	5	22
"	" " "	" "....	" Parrott....	8, " "	9-10	5	23
"	M. geometry.....	Math. 2c....	Gardner....	8, " "	2-3	5	23
"	" " "....	" "....	" "....	11-12	5	18	
"	" " "....	" "....	" "....	Abbot hall....	2-3	5	21
"	" " "....	" "....	Mr. Harza....	8, College hall.	2-3	5	16
"	" " "....	" "....	" "....	Dairy....	11-12	5	23
"	Mensuration.....	Math. 3....	Gardner....	8, College hall.	10-11	5	16
"	" " "....	" 3....	" Harza....	Dairy....	10-11	5	20
"	" " "....	" 3....	" Parrott....	8, College hall.	1-2	5	21
Freshmen....	Ag. & W. pl. trig..	Math. 4a....	Harza....	College hall....	1-2	5	21
"	" " "....	" "....	" "....	8-9	3	25	
"	" surv'g (class)..	Civil eng. 1a	Prof. Vedder..	2, College hall.	8-9	2	19
"	" " (field) ..	" " "....	{ Prof. Vedder & Mr. Waterbury }	" " "....	1-3	2	19
"	Mech. trigonometry	Math. 4b....	Prof. Babcock.	6, College hall.	9-10	5	21
"	" " "....	" "....	" "....	6, " "	11-12	5	25
"	" " "....	" "....	Mr. Parrott....	Abbot hall....	2-3	5	23
Sophomores...	Ag. surv'g (class)..	Civil eng. 1a	Prof. Vedder..	2, College hall.	8-9	2	32
"	" " (field) ..	" " "....	{ Prof. Vedder & Mr. Waterbury }	" " "....	1-3	2	16
"	" " "....	" "....	{ Prof. Vedder & Mr. Waterbury }	" " "....	1-3	2	16
"	" pl. trig.....	Math. 4a....	Prof. Babcock.	6, College hall.	10-11	3	12
"	" " "....	" "....	Mr. Parrott....	Abbot hall....	8-9	3	22
"	Integral calculus..	" 6b....	Prof. Babcock.	6, College hall.	8-9	5	25
"	" " "....	" "....	Mr. Parrott....	Abbot hall....	9-10	5	23
"	W. geometry.....	" 2b....	" Waterbury	Dairy....	9-10	5	25
Juniors.....	Dif. equations.....	" 8....	Prof. Babcock.	6, College hall.	10-11	2	28
"	H. surv'g (class)..	Civil eng. 6.	Prof. Vedder..	2, " " "	9-10	3	9
"	" " (field) ..	" " 6.	{ Prof. Vedder & Mr. Waterbury }	" " "....	1-4	6	9
Seniors.....	" " (class) ..	" " 6.	Prof. Vedder..	2, College hall.	9-10	3	15
"	" " (field) ..	" " 6.	{ Prof. Vedder & Mr. Waterbury }	" " "....	1-4	6	15
"	Masonry & arches.	" " 9.	Mr. Waterbury	2, College hall.	10-12	8	15
"	Pavements.....	" " 10.	Prof. Vedder..	2, " " "	9-10	2	15
"	Thesis.....	" " 11.	" " "....	" " "....	1-5	12	15
Totals.....	33 sections.....					146	653
Grand totals	87 sections.....					403	1826

For the first three weeks of the fall term the sub-division into sections was somewhat different from that shown in the above tabulation. This was occasioned by a change in the number of instructors provided, which took place October 3. The changes were not significant enough to call for notice in the tabulation, and mention is made of them only for the sake of historical accuracy.

EQUIPMENT.

There have been added to our instrumental equipment an Abney level; one dumpy level, with fixed stadia wires; one engineer's transit; a universal level trier; three steel tapes, respectively 200 feet, 300 feet and

500 feet long; four Philadelphia leveling rods; and three band chains. We have also purchased a number of sets of specifications for engineering structures and foundations; as well as supplies of tracing cloth, blue print paper and office stationery. A number of our surveying instruments have been repaired and adjusted at considerable expense.

By way of office furnishing, we have supplied during the year linoleum for the floor, a letter scale and 25 pamphlet cases.

A number of engineering photographs have been secured, some small tools have been purchased, and a large number of minor repairs have been made.

The total expenditure by the department during the year for all purposes has been \$868.28, of which \$88 was turned in for special examinations. The aggregate of the amount apportioned to the department by the Board during the year is \$840.43, of which \$60.15 remains unexpended.

The inventory of department property, including instrumental equipment, class-room and office furniture, observatory apparatus and tools shows an aggregate of \$5,321.86 on June 30, 1903, as against \$4,818.45 last year.

Respectfully submitted,

H. K. VEDDER,

Professor of Mathematics and Civil Engineering.

Agricultural College, Mich.

June 30, 1903.

REPORT OF THE DEPARTMENT OF ZOOLOGY AND PHYSIOLOGY.

To the President:

I have the honor to submit the following report of the Department of Zoology and Physiology for the year ending June 30, 1903:

The schedule of classes for the year was as follows:

Fall Term.—Systematic and economic Zoology for senior agriculturals and women, elective, 23 students. Anatomy and Physiology for sophomore agriculturals, required, 27 students. The same for women, 45 students. Total for term, 95 students.

Winter Term.—Geology for agricultural and women seniors, elective, 35 students. Anatomy and Physiology for agricultural sophomores, required, 43 students. The same for women sophomores, 42 students. Physical geography for mechanical sub-freshmen of five-year course, required, 87 students (in two classes). Entomology for fruit course specials, 9 students. Total for term, 216 students.

Spring Term.—Ornithology for senior agriculturals and women (elective in place of meteorology), 11 students. Geology for senior agriculturals and women, elective, 20 students. Entomology for junior horticulturals, required, 12 students. Entomology for sophomore agriculturals, required, 23 students. Physical geography for sub-freshmen women of five-year course, required, 33 students. Total for term, 99 students. Total number of students for the year, 410.

There has been no change in the teaching force of the department

during the year, and it is believed that in spite of a considerable increase in the number of classes and students the work has been fully as efficient as heretofore. The number of students handled in the winter term, however, has taxed our single laboratory beyond its limit and the temporary shifts which have been resorted to should be replaced by more ample accommodations before another winter.

The most noteworthy addition to the equipment has been the purchase of five new compound microscopes, with the necessary accessories, without which the laboratory work in anatomy and zoology would not have been possible.

Aside from class and laboratory work, which occupy so large a part of the time of the teaching force, much has been done in preparing lantern and microscope slides for illustration and study, and the department now has a collection of 490 lantern slides and about 900 microscopic mounts.

Work on the bulletin on the Birds of Michigan has been continued, but, owing to the large amount of teaching and correspondence, progress has been slow and it is impossible to say how soon it can be completed. Some additional field work should be done to render our knowledge of northern birds more complete, but the larger part of the remaining work is technical and clerical, and with sufficient help could be finished very promptly.

Study of the bird population of the College campus has been continued, and a statistical paper on this subject was read before the American Ornithologists' Union at its annual meeting in Washington in November, and probably will be published soon. The effort to increase the number of valuable wild birds on the campus, begun several years ago, has been measurably successful, and the partial failures in some directions are not without plausible explanations. One of the large martin boxes erected on the campus in 1899 is occupied this summer for the first time by a small colony of Purple Martins. It was my wish and intention to put this box in the open at first, but owing to the objections of the superintendent of grounds it was placed among tall spruces whose tips surrounded and hid the box. Last year it was found necessary to cut the tops of these spruces so as to allow the use of the telescope in the observatory near by, and the change evidently made the place acceptable to the martins who at once appropriated several compartments in spite of the remonstrances of the sparrow tenants. Wrens have continued to increase on the campus and more than a dozen pairs are nesting here this summer, but as yet no bluebirds have been prevailed upon to accept the quarters provided for them. As stated last year this avoidance of the campus by the bluebird appears to be due mainly to the presence in large numbers of English sparrows and red squirrels. Probably it is not feasible to exterminate the former, however desirable such a riddance might be, but it is entirely possible to kill off the red squirrels, and it seems advisable to try the experiment. There is little doubt in my mind that there would be an immediate increase in the number of smaller birds nesting on the campus, and I feel reasonably sure that the bluebird would be one of them. Of course it would be very desirable to lessen the number of domestic cats as far as possible, and the campus would be better if the blue jays were reduced to one-half their present numbers, but this last bird is one of the few which remains with us all winter and his beauty of plumage and interesting

habits go far to condone the obvious defects of his summer life. There would be no difficulty in restoring the red squirrels to their former abundance if it proved desirable; or, in all probability, it would be possible to introduce fox squirrels, which would take their place, and which do not appear to disturb the birds so seriously.

The distribution of insect collections to high schools throughout the State has been continued so far as circumstances would permit, but was temporarily suspended by the inability to secure the necessary cases. One hundred cases had been promised for the summer of 1902, but owing to a misunderstanding incident to the change in the College secretaryship only fifty were made and it was found impossible to get any more from outside parties until late in December. Fifty of these will be filled and distributed during the present summer. From the numerous letters of thanks and inquiry it is obvious that this effort to increase the interest in popular natural history is being thoroughly appreciated. While it has entailed a large amount of vacation work and no little expense to the department, I believe the returns will more than justify all expenditures.

THE GENERAL MUSEUM.

Rather more than the usual amount of work has been done in the general museum during the year and the collections are in a fairly good state of preservation. Owing to the settling of the building, which has been going on for many years past, and the increasing unevenness of the floor of the main hall, all the case doors are either too tight or too loose, the latter allowing the entrance of moths and other museum pests and making it necessary to inspect and disinfect specimens at frequent intervals. There is no simple remedy for this condition of affairs and nothing but eternal vigilance will prevent the ultimate destruction by pests of all our valuable specimens of birds and mammals.

The congestion due to lack of case room continues and can hardly be relieved without the removal of part or all the collections to new quarters.

Probably the most noteworthy single accession during the year is the Reed City Meteorite, previously undescribed, which was purchased from the finder, Mr. Ernest Ruppert, of Reed City, Michigan, in January last, and was cut and prepared at Ward's Natural Science Establishment, Rochester, N. Y. This meteorite originally weighed about 44 pounds and by exchange of a portion of this we secured for the museum a large polished and etched slice of the Grand Rapids meteorite, a nice fragment of the Allegan (Mich.) aerolite, showing a part of the fused crust, and a nice specimen of a Kansas siderolite. This gives the College good samples of all the meteorites yet discovered in Michigan, as well as good examples of the three principal types of these celestial missiles. We had formerly only a single example of meteoric iron, a fragment of a siderite from Toluca, Mexico.

As will be seen by reference to the College inventory, the valuation of the museum—cases and specimens alone—for the current year is estimated at \$17,853.75.

Respectfully,
WALTER B. BARROWS,

Professor of Zoology and Physiology and Curator of the General
Museum.

Agricultural College, Mich.
June 30, 1903.

REPORT OF LIBRARIAN.

To the President:

I have the honor to present the following report on the library for the year ending June 30, 1903:

During the year we have added to the library 864 bound volumes, of which 382 were purchased; 252 were donated, and 230 by binding. Unbound volumes and pamphlets to the number of 405 have been received, and in all cases where the donors were known, have been acknowledged. We therefore omit individual mention.

For gifts of bound volumes we are indebted as follows:

- | | |
|---|---|
| American Duroc Jersey Ass'n, 2. | State Board of Health, 2. |
| Australia Board of Agr. (Melbourne), 1. | State Hort. Society, 1. |
| Allen, J. M. Locomotive, vol. 23. | Banking Commissioner, 1. |
| Amer. Vet. Medical Ass'n, 2. | Legislative Manual. |
| Beal, W. J., 7. | Mineral statistics. |
| Butterfield, I. H., 1. | Minn. Geol. and Nat. Hist. Survey, 1. |
| Butterfield, K. L., 2. | Missouri Hort. Society, 1. |
| Chase, Chas. E., 1. | Mass. Board of Agriculture, 1. |
| Canada Reports, 23. | McMillan, Hon. Jas., 1. |
| Creamery Package Mfg. Co., 1. | Maybury, Hon. W. C., 1. |
| Cal. Hort. Soc., 1. | M. A. C. Prohibition League, 2. |
| Cal. University, 1. | Missouri Board of Agriculture, 2. |
| Florida, Supt. Public Instruction, 2. | Maine Board of Agriculture, 3. |
| Garfield, Hon. C. W., 1. | Maine State Board of Health, 1. |
| Hampshire Down Breeders' Ass'n., 1. | Missouri Botanical Gardens, 1. |
| Harvard University, 5. | Meyers, W. J., 1. |
| Houghton, Mifflin & Co., 1. | Melbourne University, 3. |
| Iowa State B'd of Agriculture, 1. | N. Y. State Library, 2. |
| Indiana State B'd of Agriculture, 1. | N. Y. State Museum, 1. |
| Illinois State B'd of Agriculture, 2. | N. Y. State University, 7. |
| Illinois Public Charities, 1. | National Conference of Cor. and Char., 1. |
| Jennings, A. G., 1. | New Brunswick B'd of Agriculture, 1. |
| Kansas Board of Agriculture, 4. | Oregon Board of Agriculture, 1. |
| Kansas Academy of Sciences, 1. | Ohio Board of Agriculture, 1. |
| Lawes & Gilbert (England), 1. | Patriarche, H. K., 1. |
| Louisiana State B'd of Agriculture, 2. | Putnam's Sons, 1. |
| Michigan reports: | Red Polled Cattle Club, 1. |
| Supt. Public Instruction, 2. | Rhode Island B'd of Agriculture, 3. |
| Labor Bureau, 1. | Smith, Hon. S. W., 10. |
| State B'd of Cor. and Charities, 1. | Smithsonian Institution, 4. |
| Secretary of State, 4. | University of Michigan, 1. |
| State Board of Agriculture, 1. | Utah Supt. of Public Instruction, 1. |
| State Library, 1. | |

United States reports, as follows:

- | | |
|------------------------------------|---------------------------------------|
| Census Bureau, 8. | Interior Department, 7. |
| Interstate Commerce Commission, 5. | Treasury Department, 18. |
| Naval Observatory, 1. | War Department, 16. |
| Civil Service Commission, 3. | Gov't. Exhibit at Tenn. Exposition. |
| Bureau of Education, 11. | Virginia State B'd of Agriculture, 1. |
| Department of Agriculture, 20. | Walker, Admiral, 1. |
| Labor Bureau, 4. | |

One hundred fifty-six publications, foreign and American, are purchased by the College and placed in the reading room for the use of faculty and students. In addition to these are the following publications which are regularly received as donations or in exchange for our own publications:

Adrian Times.	Hillsdale Standard.
Allegan Gazette.	Horse World.
Agricultural Epitomist.	Horticultural Visitor.
Agricultural Gazette of N. S. Wales.	Improvement Era.
Agricultural Advertising.	Indiana Farmer.
American Bee Keeper.	Ionia Sentinel.
American Blacksmith.	Lansing Journal (daily).
American Creamery.	Lansing State Republican (daily).
American Horsebreeder.	Literary News.
American Horticulturist.	Live Stock Journal.
American Thresherman.	Locomotive.
American Phil. Society, Proc.	Midland Republican.
American Swineherd.	Michigan Mirror.
Baltimore Sun.	Michigan Sugarbeet.
Battle Creek Journal.	Michigan Bulletin Vital Statistics.
Beet Sugar Gazette.	Moderator.
Big Rapids Herald.	Michigan Presbyterian.
Capitol City Democrat.	National Stockman and Farmer.
Chicago Drovers' Journal (daily).	National Farmer and Stock Grower.
Christian Science Herald.	N. Y. Produce Review.
Christian Science Journal.	N. Y. Weekly Witness.
Christian Science Sentinel.	Otsego County Champion.
Clinton Independent.	Onekema Lake Breeze.
Church Helper.	Oregon Agriculturist.
Chicago Packer.	Orange Judd Farmer.
Detroit Free Press (twice-a-week).	Official Gazette.
Dairy and Produce Review.	Pinckney Dispatch.
Evening News (Saginaw).	Petoskey Independent Democrat.
Farm and Fireside.	Park's Floral Magazine.
Farmers' Voice.	Practical Farmer.
Farming World.	Proc. Amer. Soc. Civil Engineers.
Farm Field and Fireside.	Plymouth Weekly.
Farmers' Advocate.	Science and Industry.
Farmers' Home.	South Haven Messenger.
Farmers' Guide.	Sugar Beet.
Farmers' Journal.	Salt Lake Herald.
Farm and Home.	Sunfield Sentinel.
Farm Journal.	Traveler's Record.
Farming World.	Traverse Bay Eagle.
Farm News.	Voice, The New.
Fruit Growers' Journal.	World's Fair Bulletin.
Florists Exchange.	Western Fruit Grower.
Good Health.	Wolverine Citizen.
Gleanings in Bee Culture.	Women's Home Companion.
Grand Ledge Independent.	Wallace Farmer.
Grand Rapids Evening Post.	West. Society of Engineers.
Grange Bulletin.	Williamston Enterprise.
Homestead.	Yale Expositor.
Hillsdale Leader.	Ypsilantian.

The M. A. C. Record exchanges are also placed in the reading room, and in exchange for our catalogue, the library receives the year books, catalogues or registers from all the leading institutions of the country. We also receive the bulletins of the various State experiment stations, and of the U. S. Department of Agriculture.

During the year fines to the amount of \$20.27 have been collected, and

4,050 books have been loaned. No record of books used in the library has been kept. Seventy-seven books have been repaired or rebound.

The library hours remain unchanged.

The library of the Experiment Station grows but slowly. During the year 63 books have been added, of which 11 were purchased, 25 donated, and 27 by binding. This library now contains 2,050 volumes, the College library numbers 21,953 volumes; total in both libraries, 24,003 volumes.

We take pleasure in commending our assistant, Mr. H. K. Patriarche, whose work has been faithful, painstaking, and in every way satisfactory to ourselves and our patrons.

Respectfully submitted,

LINDA E. LANDON,
Librarian.

Agricultural College, Mich.
June 30, 1903.

REPORT OF DEPARTMENT OF HISTORY AND ECONOMICS.

To the President:

I take pleasure in submitting the following report of the work in my department during the past year. During the autumn term two classes recited to me each day during the week. One—a class of seniors in the constitutional history of the United States—numbered twenty-four, and the other—sophomore women in European history—numbered forty.

Through the adoption of the five-year course of study such a rearranging of classes took place as to bring into the winter term of this year so large an amount of teaching as to necessitate an assistant. Miss Alice Gunn was secured for this purpose and proved very satisfactory. The work under her direction was the English history class, numbering about forty-five. During this term there came under my own direction a class of seniors in political economy numbering eighteen, a class of juniors in political science numbering sixty-three, and a class of junior women in early European history numbering fourteen. A plan was adopted by the faculty during this term whereby students in the mechanical department are given an option between history and economics and foreign languages.

The spring term of this year, through the generosity of my employers, was spent at the University of Michigan in pursuing advanced study of political economy.

In consequence of the additional studies in my department (noted in my last report) through the adoption of the five year program and with the increasing numbers of our students more teaching is required from this department than can be performed by one person. Some terms, for instance, have six hours per day scheduled for this department with a different subject of study for each of five, at least, of the required hours. It seems imperative therefore that additional means be given this department to adequately take care of this additional and rapidly increasing work and I sincerely hope consideration may be given to the need of a permanent assistant.

Very respectfully,

June 30, 1903.

WILBUR O. HEDRICK.

REPORT OF THE ENGLISH DEPARTMENT FOR THE YEAR
1902-1903.

To the President:

The year just passed has been one of quietude and steady routine work in this department. The class work has all been performed by the four members of the department with one exception. At the opening of the winter term, on organizing the beginning class in German provided for in the sophomore year of the mechanical course, I found it necessary to divide the class (fifty-seven in number) into two sections. It was impossible for any member of the department to take the extra section both on account of the schedule and because of the heavy work each teacher was carrying. We were fortunate in obtaining the help of Miss Hannah Bach, who very acceptably and successfully performed the work during the term.

I want to commend the excellent work of my assistants during the year. It would be hard to find more earnest, hard-working, conscientious and efficient teachers than they are. The new member, Mr. Sawtelle, has measured well up to all the requirements made upon him and is showing himself a valuable addition to the corps.

I append a detailed tabulated statement of our work for the year. It does not, of course, show the essay work, done outside of class, partly by the teachers of the classes, partly by readers paid from the fund set aside by the Board as recommended by me last year. Not all of this fund was used. I have recommended a continuance of the arrangement for next year.

Respectfully submitted,

HOWARD EDWARDS,

Professor of English Literature and Modern Languages.

STATISTICAL TABLE.

Showing extent and arrangement of work in the English department for the year 1902-1903.

Class.	Subject.	Teacher.	Hour.	Days of week.	No. of students.
<i>Fall term, 1902:</i>					
Sub-Freshmen	English 1a.....	Miss Wellman....	8-9	Monday, Wednesday, Friday...	27
	English 1a.....	Miss Wellman....	10-11	Monday, Wednesday, Friday...	38
	English 1a.....	Mr. King.....	9-10	Monday, Wednesday, Friday...	51
	English 1a.....	Mr. Sawtelle....	9-10	Monday, Wednesday, Friday...	28
	English 1a.....	Mr. Sawtelle....	11-12	Monday, Wednesday, Friday...	35
	English 1a.....	Mr. Edwards....	8-9	Monday, Wednesday, Friday...	35
	English 2a.....	Miss Wellman....	8-9	Monday, Wednesday, Friday...	28
	English 2a.....	Miss Wellman....	10-11	Tuesday, Thursday.....	40
	English 2a.....	Mr. King.....	9-10	Tuesday, Thursday.....	51
	English 2a.....	Mr. Sawtelle....	9-10	Tuesday, Thursday.....	29
Freshmen.....	English 2a.....	Mr. Sawtelle....	11-12	Tuesday, Thursday.....	33
	English 2a.....	Mr. Edwards....	8-9	Tuesday, Thursday.....	35
	English 3a.....	Mr. King.....	10-11	Monday, Wednesday.....	21
Sophomore....	English 3a.....	Mr. King.....	10-11	Tuesday, Thursday.....	25
	English 2c.....	Miss Wellman....	9-10	Tuesday, Thursday.....	20
	English 2c.....	Miss Wellman....	1-2	Monday, Wednesday.....	24
	English 2c.....	Miss Wellman....	2-3	Tuesday, Thursday.....	35
	English 2c.....	Mr. Sawtelle....	2-3	Monday, Wednesday.....	32
	English 2c.....	Miss Wellman....	9-10	Monday, Wednesday.....	36
Junior.....	English 2c.....	Mr. Edwards....	8-9	Monday, Wednesday.....	27
	English 4.....	Mr. King.....	8-9	Monday, Tuesday, Friday.....	28
	English 4.....	Mr. Edwards....	10-11	Monday, Wednesday, Friday.....	26
	English 3d.....	Mr. King.....	1-2	Tuesday, Thursday.....	17
	English 3d.....	Mr. King.....	8-9	Wednesday, Thursday.....	36
	English 7a.....	Mr. King.....	4-5	Thursday.....	26
	German 1c.....	Mr. Edwards....	3-4	Daily.....	18
	German 1a.....	Mr. Sawtelle....	3-4	Daily.....	28
Senior.....	French 1a.....	Mr. Sawtelle....	8-9	Daily.....	13
	English 7c.....	Mr. King.....	4-5	Tuesday.....	39
	German 2a.....	Mr. Edwards....	9-10	Daily.....	13
<i>Winter term, 1903:</i>					
Sub-Freshmen	English 1b and 2b..	Miss Wellman....	8-9	Daily.....	27
	English 1b and 2b..	Miss Wellman....	9-10	Daily.....	25
	English 1b and 2b..	Miss Wellman....	10-11	Daily.....	29
	English 1b.....	Mr. Sawtelle....	3-4	Monday, Wednesday, Friday...	41
	English 2b.....	Mr. Sawtelle....	3-4	Tuesday, Thursday.....	40
	English 1b and 2b..	Mr. King.....	1-2	Daily.....	35
	English 2b.....	Mr. King.....	11-12	Tuesday, Thursday.....	33
Freshmen.....	English 1b.....	Miss Wellman....	11-12	Monday, Wednesday, Friday...	33
	English 3b.....	Mr. King.....	10-11	Wednesday, Friday.....	24
	English 3b.....	Mr. King.....	2-3	Monday, Wednesday.....	25
Sophomore....	English 3c.....	Mr. King.....	10-11	Thursday.....	24
	English 4.....	Mr. King.....	3-4	Monday, Wednesday, Friday...	43
	English 2f.....	Mr. Edwards....	2-3	Monday, Wednesday.....	44
	English 2d.....	Miss Wellman....	11-12	Thursday.....	34
	English 2d.....	Miss Wellman....	1-2	Wednesday.....	26
	English 2d.....	Miss Wellman....	1-2	Thursday.....	24
	English 2d.....	Miss Wellman....	1-2	Friday.....	25
	German 1a.....	Mr. Sawtelle....	11-12	Daily.....	31
Junior.....	German 1a.....	Miss Bach.....	11-12	Daily.....	26
	English 5a.....	Mr. Edwards....	10-11	Mon., Tues., Wed., Thursday...	52
	English 7b.....	Mr. King.....	5-6	Thursday.....	29
	English 8c.....	Mr. King.....	2-3	Tuesday, Thursday.....	12
	English 8c.....	Mr. King.....	3-4	Tuesday, Thursday.....	22
	German 3a.....	Mr. Edwards....	1-2	Daily.....	23
	German 1b.....	Mr. Sawtelle....	9-10	Daily.....	19
Senior.....	French 1b.....	Mr. Sawtelle....	1-2	Daily.....	12
	English 5d.....	Mr. Edwards....	11-12	Daily.....	15
	English 7d.....	Mr. King.....	5-6	Tuesday.....	25
	German 2b.....	Mr. Edwards....	9-10	Daily.....	12

* Met twice per week with Division 1.

Extent and arrangement of work in English department.—Concluded.

Class.	Subject.	Teacher.	Hour.	Days of week.	No. of students.
<i>Spring term, 1903:</i>					
Sub-Freshmen	English 2c and 2d	Miss Wellman	8-9	Daily	25
	English 2c	Miss Wellman	9-10	Monday, Tuesday, Friday	36
	English 2c and 2d	Miss Wellman	2-3	Daily	27
	English 2c	Miss Wellman	3-4	Tuesday, Thursday, Friday	34
	English 2c and 2d	Mr. King	9-10	Daily	33
Freshmen	English 3c	Mr. King	11-12	Monday, Wednesday	15
	English 3c	Mr. King	3-4	Tuesday, Thursday	17
Sophomore	English 2e	Miss Wellman	10-11	Monday, Wednesday	40
	English 2e	Miss Wellman	9-10	Wednesday, Thursday	24
	English 2g	Mr. Edwards	1-2	Tuesday, Thursday	44
	German 1b	Mr. Sawtelle	8-9	Daily	32
	German 1b	Mr. Sawtelle	9-10	Daily	21
Junior	English 3f	Mr. King	8-9	Tuesday, Thursday	17
	English 3f	Mr. King	10-11	Monday, Wednesday	21
	English 5b and 5c	Mr. Edwards	9-10	Daily	65
	English 6	Mr. King	8-9	Monday, Wednesday, Friday	15
	French 1c	Mr. Sawtelle	11-12	Daily	10
	German 1c	Mr. Sawtelle	3-4	Daily	13
Senior	German 3b	Mr. Edwards	11-12	Daily	28
	English 5e	Mr. Edwards	8-9	Daily	33
	English 7d	Mr. King	11-12	Tuesday	17
	German 2c	Mr. Edwards	2-3	Daily	7

DEPARTMENT OF PHYSICS AND ELECTRICAL ENGINEERING.

President J. L. Snyder:

I submit herewith my report for the year ending upon this date.

COURSES GIVEN.

The following additions and exceptions to the regularly scheduled courses were found necessary during the year, viz.: In the fall term a second term's work was added to the course in elementary physics for the five-year mechanical students. This addition will result in a much more adequate preparation of these students for the subsequent courses in this department.

There was added also an introductory course for the five-year agricultural and women students, intended to introduce them to the study of the exact sciences, as preparatory to their work in chemistry the next term.

There was cut from the courses offered the senior elective for the spring term for women and agricultural students. This course was only temporarily suspended owing to lack of an instructor.

INSTRUCTORS.

Early in the year Mr. A. H. Taylor, for several years an efficient instructor in the department, resigned his position to take up work elsewhere. It was found difficult to find a man to fill this instructorship. It thus became necessary for the remaining two men to carry throughout the most of the year the work of three. As this report is being written the

vacancy has been filled by the appointment of Mr. H. L. Curtis from the graduate school of the University of Michigan.

ADDITIONS TO EQUIPMENT.

Additions to the working equipment of the department here consisted in the main of remodeling and reconstructing stock pieces already on our shelves. The eight-inch induction coil has been rebuilt and provided with an adjustable condenser and independent vibrator of latest approved type. The air pump has been rebuilt and equipped with power attachment. A five horse power D. C. motor has been purchased for the electrical laboratory. During the early part of last summer there were built and installed, under the direction of the director of the department and from designs made by him, a large number of pieces for laboratory work. By this method not only were the pieces better suited to our special needs but also the cost was very materially lessened. The expenditure of two or three hundred dollars in installing a suitable shop for the repair and construction of apparatus, and the appointment of a capable mechanic as "Instrument maker," as is done in other institutions, would be a source of great saving and convenience; not alone to this, but also to many other of the College departments.

WORKING QUARTERS.

Through the going into operation of the new five-year courses several classes lapsed which will next year have to be provided for. Even under this condition—the number of students being thereby somewhat lessened—it was found impossible to find recitation rooms for our classes. The futility of attempting to reach satisfactory results with classes of eighty students for recitation under a single instructor, and in rooms unprovided with blackboard facilities is too patent to need comment.

The ill-lighted, unsanitary basement in which all our laboratory courses are conducted is not only a menace to the health of those compelled to work therein, but acts also as a strong deterrent to the doing of good work. To those of our students who come from the well-equipped laboratories of our better high schools the conditions existent are discouraging at the outset. While all students are influenced toward careless and slovenly work and methods by such inadequate and unsuitable accommodations. I feel that I cannot too strongly again urge this matter upon your attention for immediate action as demanded by consideration of the health of our students and instructors, and the success of their work.

STUDENTS ENROLLED.

There were enrolled during the year the following numbers of students in the several courses:

Agricultural	105
Women's	100
Mechanical	224
Total	429

Very respectfully submitted,

MARTIN D. ATKINS,
Professor of Physics and Electrical Engineering.

June 30, 1903.

REPORT OF THE VETERINARY DEPARTMENT.

To the President:

In reporting the work of the Veterinary Department for the year ending June 30, 1903, I have nothing new to offer; the work of the department has been carried on in very much the same manner as in former years; methods are modified from time to time as the condition of the classes seems to require.

We try at all times to keep in mind that the object of the department is to give a practical course for the young men who expect to engage in stock raising, and so while we discuss the diseases as to their causes, symptoms and treatment, we also call attention to the veterinary side of stock judging, breeding and feeding.

The seniors had the opportunity of electing the work throughout the entire year; the sophomores received thirty lectures during the first half of the winter term, and the special short course students also received thirty lectures during the same term. These classes met at different hours and the lectures varied somewhat, according to the requirements of the students.

Respectfully submitted,

GEORGE A. WATERMAN,
Professor of Veterinary Science.

Agricultural College, June 30, 1903.

REPORT OF MILITARY DEPARTMENT.

Dr. J. L. Snyder, President Michigan Agricultural College:

I have the honor to make the following report of the Military Department for the year ending June 30, 1903.

As far as time would permit, the corps has been advanced in compliance with General Orders No. 94, Series of 1902, Adjutant General's Office. It has been instructed practically in gallery target practice, each cadet firing fifteen shots at the ranges two, three and six hundred yards. Great interest has been manifested in the work. Guard duty has been performed by every cadet, outpost, advance and rear guards. Extended order drill by company. Battalion drill in close order and all ceremonies. First aid to the injured, also signal drill by a detachment. It is impossible to give all the instruction required by the order of the War Department unless the full allowance of time—"a minimum of five hours per week," be assigned the department.

Attention is again called to the very bad hours for the work, 5 to 6 p. m. In the fall term it is dark when the work begins. It is the most important time for discipline, as the freshmen enter the department for the first time. I cannot be responsible for bad behavior or other mishap at this

time, as it is impossible to distinguish individual cadets. Unless I can properly see the work going on, it is really wasted time. Another important thing in this connection is that these hours are particularly bad on account of the cadets being tired and worn out with their shop and class work when they report. I think the time has come when the Military Department should have the same consideration shown it that any other department of the College has. The matter of a "drill shed" is again most urgently requested with the hope that favorable action will result. A drill hall, gymnasium and auditorium, for which purposes the present armory is used, must of necessity interfere with each other. The two departments Military and Athletic should be divorced. Good results have been brought about by separate drill ground and athletic field.

The military spirit and discipline of the corps has improved in a marked degree.

In arranging the schedule for the last half of the spring term, a day should be set apart for the annual inspection by the War Department, similar to those arranged for the Inter Collegiate meetings, so that classes could be stopped, the cadets given time to prepare for this important matter; as it is now, they come out of shop and class work to undergo a hard strain. Since I have been on duty here no preparation has been made for this annual event.

Trusting that action will be taken on the recommendations made.

Very respectfully,

C. A. VERNOU,

Major U. S. Army.

June 30, 1903.

REPORT OF THE DEAN OF SPECIAL COURSES.

To the President:

The attendance upon the Special Courses last winter was more than satisfactory. The attendance by courses was as follows:

General Agriculture	50
Creamery Management	59
Fruit	9
Beet Sugar	14
Cheese	16

A greater proportion of the students attending these courses than usual were graduates of high schools. The quality of the work done was conspicuously good. Most of the young men came here directly from the farm with the expectation of returning to the farm upon the completion of the course; they knew, therefore, both the limitations of their knowledge and training and the things required to better fit them for their life work. It would be hard to find a class of students more genuinely enthusiastic than these young men of the short courses. The general

criticism of the courses as laid out was that the time was too short, although many in attendance confessed that if at the outset the term offered had been twelve weeks instead of six they could not possibly have come.

I wish to speak here in commendation of the work done in live stock. The College needs a judging pavilion in which the boys can be comfortable while studying animal form but notwithstanding the present limitations in this regard probably no feature of the course was more attractive and more helpful than the work in the yards and class rooms examining and comparing the forms of the live stock presented to them.

The Veterinary work was also enthusiastically received and will prove of great and permanent benefit. I hope that before another winter it will be possible to extend the course by including practical demonstrations in the cutting up of meats and the judging of carcasses as a whole or in sections. The work in soils and plant life was systematically arranged and formed a very complete entity. The students understood the reason for the different operations on the farm and will be able to conduct their work more intelligently hereafter.

In the Creamery course there was felt the same want of sufficient time to thoroughly understand the topics treated. Six weeks is not long enough to afford even decent training in dairy manipulation, giving all a thorough understanding of bacteriology of the subject and the preparation of cultures. The work as far as carried was very satisfactory, however, and the class was abundantly satisfied.

I am glad to report that the Board has recently permitted the extension of these two courses to twelve weeks each to as many students as so elect.

The Fruit course was attended but by nine students; every one in attendance pronounced himself as more than gratified with the quality and quantity of the work offered. It is to me a mystery that this course is not better patronized in a state like Michigan which is noted for its fruits.

The course in Beet Sugar Production was limited to the spring term and the students were required to get their preparatory training elsewhere. The numbers received were limited to twelve on account of the lack of room in the Chemical Laboratory. Two improvements are called for in this course: First, The teaching of mechanics; and Second, The offering of preliminary training in chemistry. Unless, however, the factories can so arrange their affairs as to offer the young men who have taken this course steady work through the year there is small inducement to build up a strong course.

Respectfully submitted,

C. D. SMITH,

Dean of Special Courses.

Agricultural College, Michigan,
June 30, 1903.

REPORT OF THE STATE INSPECTOR OF NURSERIES AND ORCHARDS.

To the State Board of Agriculture:

I have the honor to present herewith my report as Inspector of Nurseries and Orchards for the eleven months ending June 30, 1903.

When I assumed the responsibilities of the position, August 1, 1902, the season for the inspection of the nurseries of the State was at hand and this work was taken up at once. On the fifteenth of October all of the nurseries of whose existence I was aware, had been inspected and all but two had been examined by myself. The nursery trees were for the most part found to be in excellent condition. Here and there cases of black peach aphid, wooly aphid, crown gall and other dangerous insects were discovered and the trees were ordered destroyed except in the case of the peach aphid when the trees were given a certificate after they had received treatment. At a number of places, San Jose scale was discovered but, in a majority of instances, the insects were confined to a few trees on the grounds of dealers in nursery stock who only had a few surplus trees that they had heeled in. In one instance it seemed probable that the scale had been brought into the State upon a single tree but in the others, the premises were located in villages where the scale was found to be present upon trees growing in the gardens and the nursery stock had evidently become infested after it was planted out. In all cases the infested trees were destroyed.

At two places only was the scale found upon trees growing in the nursery. All the trees upon which the scale could be found were destroyed and the others were fumigated before they received a certificate.

While the law permits the selling without a license of surplus plants by any grower of small fruit it requires all nurserymen to have any stock they sell inspected. In various parts of the State, and especially in Berrien county, there are a large number of persons who make a business of selling their surplus strawberry, raspberry and blackberry plants to the nurserymen in their vicinity, and in order that they may be sold under the licenses of these nurseries they have to be inspected. During the year one hundred and fifty such inspections were made and certificates were furnished wherever the plants were found free from insects and diseases. With few exceptions they were in excellent condition.

Early in the fall it became evident that the scale had become quite generally distributed in a number of villages and cities and in order that the requirements of the law might be complied with, and the suspected places visited and inspected, the appointment of a number of deputies became necessary as during the fall and winter months, my duties as Superintendent of Farmers' Institutes took the greater part of my time. The following appointments were made: E. B. Bennett and O. L. Ayrs to be general deputies, and Leo M. Geismar, of Chatham, Superintendent of the Upper Peninsula Experiment Station, and T. A. Farrand, Superintendent of the South Haven Sub-Station were appointed special deputies for work in their sections. The latter appointments were made to save time and traveling expenses where calls came in from the northern and western

parts of the State that could readily be looked after by these deputies but which would otherwise have required a special trip on my part. During the fall, frequent complaints regarding the spread of "Little Peach" in Allegan county were received and that the matter might receive proper attention, H. G. Welch, of Douglas, was appointed a special deputy for that section. During the fall and early winter, Messrs. Bennett and Ayrs spent some two months each looking up reported cases of the scale at Plymouth, Ypsilanti, Detroit, Mt. Clemens, Lansing and at other points but just before the holidays Mr. Bennett resigned to accept a position at the Connecticut Agricultural College and, soon afterwards, Mr. Ayrs gave up his position for one with the Department of Agriculture at Washington. Mr. Farrand inspected a number of nurseries in the vicinity of South Haven during the late fall and, during the winter responded to a number of calls where San Jose scale was suspected in the orchards in Van Buren and Berrien counties. Mr. Geismar has inspected but a single nursery, requiring but one day and at a cost of one dollar for traveling expenses, while it would have taken at least three days and an expense for traveling of thirty to forty dollars had the writer gone from Lansing for this purpose. Owing to the lateness of the season when Mr. Welch's appointment was made, very little work with "Little Peach" was done, but he has assisted by inspecting several nurseries and orchards, for the San Jose scale and other pests.

A large amount of work has been done by Mr. Farrand and myself in the vicinity of Benton Harbor. Early in the fall reports reached me of the presence of the scale and an endeavor was made to ascertain the extent to which it had spread. A large number of orchards, some of them covering considerable areas, were found to be infested and in several of them the trees had been very badly injured. Little, if anything, had been done to prevent the spread of the insects. In fact, very few of the fruit growers were aware of their presence. After receiving official notice many of the owners gave their orchards a thorough spraying with sulphur, lime and salt mixture and there is every reason to expect that in those cases the ravages of the scale will be checked, although it will probably be difficult to exterminate it. In a considerable number of cases, however, although the owners claim to have followed directions, there is reason to suspect that work was not as thorough as it should have been, and further attention will undoubtedly be necessary during the coming winter.

From the results in other states, where the California wash (sulphur, lime and salt), or the Oregon wash (sulphur, lime and copper sulphate) have been used, we have reason to expect that the thorough treatment of the trees during the dormant period will make it possible to prevent serious injury, but when the scale has become generally distributed in a section it is hardly probable that it can be exterminated. The materials themselves are comparatively inexpensive and, as a spraying with either wash will take the place of an application of Bordeaux mixture, it is evident that as, at most, only one application per year will be required, if the owner of an orchard infested with San Jose scale learns of the presence of the insect before it has done much harm, it can be controlled at a comparatively small expense.

We append a list of the nurseries licensed to do business in Michigan,

and a list of the dealers in nursery stock. In the latter class are included the persons who sell nursery stock on their own account but purchase all of their stock.

L. R. TAFT,
State Inspector of Nurseries and Orchards.

Agricultural College, Mich.,
June 30, 1903.

LIST OF MICHIGAN NURSERIES.

Allen, R. E.....	Paw Paw
Allen, W. E. & Co.....	Kalamazoo
American Nursery Co.....	Kalamazoo
Babcock & Nash.....	Bridgman
Baldwin, C. E. & Co.....	Augusta
Baldwin, O. A. E.....	Bridgman
Bigelow, J. N.....	Bangor
Bragg, L. G. & Co.....	Kalamazoo
Briscoe, Joseph A.....	Highland Park
Brooke, F. W.....	Ithaca
Buttrick & Beebe.....	Ada
Central Michigan Nursery Co.....	Kalamazoo
Cross, Jas. A.....	Spring Lake
Culver, O. B.....	Colon
Curtis, L. T.....	Flint
Davis Bros.....	South Haven
Dean, Geo. N.....	Shelbyville
Dressel, G. L.....	Frankfort and Hart
Dunham, E. W. & Co.....	Stevensville
Essig, W. W. & Co., 10 Cleland Bldg.....	Detroit
Ferrand, E. & Son, Vinewood Avenue.....	Detroit
Flansburgh & Pierson.....	Leslie
Ford, Geo. W.....	Saranac
Goodell, E. W.....	Mayville
Grant, Keck & Merrifield.....	Bangor and Coloma
Greening Bros.....	Monroe
Gustin, C. F.....	Adrian
Hamilton, A. & Son.....	Bangor
Hammond, H. N. Seed Co.....	Bay City
Havekost, G. H.....	Monroe
Hawley, E. & Sons.....	Hart
Herbst, Wm. G.....	Maybee
Husted, N. P.....	Lowell
Ilgenfritz, I. E. Sons Co.....	Monroe
Irving Jaquay Co.....	Benton Harbor
Jeffrey, Jas. Jr.....	Bronson
Jeffrey, Jas. Sr.....	Kalamazoo
Jeffrey & Ellis.....	Wright
Kellogg, R. M.....	Three Rivers
Knight, David.....	Sawyer

Lampson & Rood	Covert
Leathers, Wm. J. & Co.	Breedsville
Lewis, A. E. & Sons.	Lowell
Link, W. J.	Gobleville
McKee, H. R.	Coloma
Malone, Wm.	Tallmadge
Maudlin, E.	Bridgman
Merrifield & Alton	Fremont
Michigan Nursery Co.	Monroe
Milbourn, Fred.	Eaton Rapids
Morrill & Morley	Benton Harbor
Negaunee Nurseries and Greenhouses.	Negaunee
Nelson, J. A. & Son.	Paw Paw
Pearce, P. D., 48 Livingston St.	Grand Rapids
Prater, G. E. Jr.	Paw Paw
Sheldon, P. B. & Son.	Litchfield
Singer, W. H.	Lapeer
Speyers, Chas. M.	Willis
Spielman Bros.	Adrian
Stone, John & Son.	Hillsdale
Wall & Behler	Stevensville
Wanner, Louis	Glenn
Watterson, W. J. & Son.	Ada
Webb, D. S. & Co.	St. Joseph
West Michigan Nurseries	Benton Harbor
Weston, A. R. & Co.	Bridgman
Whitten, C. E.	Bridgman
Wilber, M. B. & Son.	Mecosta
Wise, Ralph	Plainwell
Wooll & Tillotson	Elsie

LIST OF FOREIGN NURSERIES.

Albaugh Nursery Co.	Phoneton, Ohio
Allen Nursery Co.	Rochester, New York
Beachy, N. C.	Rochester, New York
Bohlender, Peter & Son	Phoneton, Ohio
Bogue, Nelson	Batavia, New York
Bowman, Thos. W. & Son.	Rochester, New York
Brown Bros. Co.	Rochester, New York
Bryant Bros.	Dansville, New York
Chase Bros. Co.	Rochester, New York
Chase, R. G. Co.	Geneva, New York
Clark Nursery Co.	Waterloo, New York
Cole, W. B.	Painesville, Ohio
Empire State Nursery	Waterloo, New York
First National Nurseries	Rochester, New York
Hawks Nursery Co.	Rochester, New York
Herrick Seed Co.	Rochester, New York
Home Nursery Co.	Normal, Illinois
Knight & Bostwick	Newark, New York

Mayfield Nursery Co.....	St. Paul, Minnesota
Moulson, Geo. & Son.....	Rochester, New York
North Jersey Nurseries	Springfield, New Jersey
Pierson Bros.	Waterloo, New York
Perry Nursery Co.....	Rochester, New York
Rakestraw & Pyle	Kennett Square, Pennsylvania
Spaulding Nursery and Orchard Co.....	Spaulding, Illinois
Stark Bros. Nurseries and Orchards Co.....	Louisiana, Missouri
Western New York Nursery Co.....	Rochester, New York
Whitney, G. W & Co.....	Dansville, New York

LIST OF MICHIGAN DEALERS.

Augustine, L. D.....	St. Joseph
Averill, H. M.....	Manton
Bailey, H. A.....	Jackson
Bassage, A. W.....	Fennville
Boal, E. A.....	Hinchman
Boyd & Skinner	Central Lake
Campbell, A. H.....	Mattawan
Clapp, C. H.....	25 Brady St, Detroit
Clark, Thos. W.....	252 W. Alexandrine Ave., Detroit
Cook, R. B.....	97 Acorn St., Muskegon
Davis, S. B.....	Jackson
Dodge, Thos. T.....	Lawton
Dow, H. C.....	Spring Grove
Filer, A. C.....	Sault Ste. Marie
Green, A. W. & Son.....	Grass Lake
Harper, C. W.....	Lawton
Healy, Wm.	Bloomington
Hills, Wilson	Davison
Ilgenfritz, E. C. & Co.....	Monroe
Kimball, D. S.....	47 Aurelia St., Detroit
Kingsbury, Lathrop	Muskegon
Knapp, Chas. E.....	Lawton
Lake Shore Nursery Co.....	St. Joseph
Lewis, Geo. H.....	Monroe
McHugh, J. J.....	118 Michigan Ave., Detroit
McQueen, F. B.....	Wayne
McVean, F. D.....	Monteith
Mosier, C. H.....	Paw Paw
Pearson, D. S.....	173 Hastings St., Grand Rapids
St. Joseph Nursery Co.....	St. Joseph
Smith, Patrick H.	310 Sheridan Ave., Detroit
Souter, Geo. H.....	Holland

Speyers, Frank Willis
 Stainton, F. J. & Bro. Lawton
 Strittmatter, Adolph 488 Chene St., Detroit
 Sweet, L. H. Carsonville

Taplin, Stephen West Fort St., Detroit
 Tyler, E. E. 236 Terrace St., Muskegon

REPORT OF CHEMICAL DEPARTMENT.

President J. L. Snyder:

In presenting my report for the year of matters pertaining to this department I wish to say that the amount of instructional work performed in class room and laboratory was greater than that done in any previous year by nearly 20 per cent. This necessitated the almost constant use from 8 a. m. to 5 p. m. of our main laboratory room during the fall and winter term, but by the use of the ventilating fan recently installed the room has been maintained in fair condition.

The following table shows how the work was divided throughout the year:

Fall term.	No. of students.	Instruction, hours per week, per student.
General chemistry:		
Agricultural and Mechanical	189	
Women	70	7
Organic chemistry:		
Agricultural	38	
Women	8	7
Total hours instruction		2,295
Winter term.		
Mineralogy, mechanical	30	5
Qual. anal. women	60	8
Qual. anal. men	52	10
Agricultural chemistry, men	33	5
Domestic science	6	10
Total hours instruction		1,737
Spring term.		
Quan. analysis	20	10
Mechanical, third term	70	6
Sugar beet specials	14	20
Total hours instruction		900

The class instruction given has been added to and modified from that heretofore given in the following particulars:

(a) The agricultural chemistry of the junior year instead of consisting entirely of lectures has now 3 lectures and 4 hours a week laboratory work by each student.

(b) A course of laboratory work and discussions on topics relating to the application of chemistry to the household was given the senior women.

(c) An elective course in quantitative analysis was given 20 senior Agricultural students. The major portion of the time being given to analysis of stock foods and fertilizers.

As the laboratory space was required by the regular college classes, the special course in chemistry of beet sugar manufacture had to be abridged to the disadvantage of the students pursuing the course. Next year I hope, owing to changes in the arrangement of the laboratory recently authorized by the board, this will not be necessary and that we shall be able as heretofore to give men from the factories and farm a practical insight into the chemistry of the factory.

As in previous years there have come in for examination and report samples in a great variety of materials, such as peat, marls, clay, stock foods, and minerals from farmers and others. Our students are thus kept in touch with the work of the outside world. I have also investigated to some extent the composition of various mixtures found in the market for use by breeders in destroying parasites on their stock. The matter seems to me to be one worthy of more extended investigation. The stock breeder needs a means of defense against these parasites, which he thoroughly understands some such a mixture as the fruit grower possesses in the Bordeaux mixture and the arsenical compounds which he so frequently uses.

The efficient help of Instructors Reed, Michael and Benner with the college classes, and Chief Chemist A. N. Clark of the Alma Sugar Co., in the special course I desire to heartily recognize in this report.

Respectfully submitted,

FRANK S. KEDZIE,

Professor of Chemistry.

June 30, 1903.

REPORT OF THE MICHIGAN WEATHER SERVICE.

To the State Board of Agriculture:

I beg to submit the following brief report of the Weather Service for the year ending June 30, 1903:

The work of this bureau has been carried forward on lines similar to those of the year preceding.

We have in operation 122 voluntary observation stations making a daily record of the temperature extremes, precipitation, cloudiness and wind direction. In addition to this there are nine regular Weather Bureau Stations, making altogether 131 places from which reports are received. This meteorological data is becoming more valuable to the people every year because it is being more generally used and the public is beginning to find out that it can be applied to many uses. This office is constantly in demand for data of various kinds and for various purposes. Several times during the past year it has been used in court in connection with lawsuits. The greatest difficulty experienced in keeping up the observation work at the 122 voluntary observation stations is the fact that the work is done daily by men who receive absolutely no remuneration, except such publications and seed distribution as this office has at its disposal. Nevertheless, the work is highly creditable.

The Weekly Climate and Crop Bulletin, which is published during the planting, growing and harvesting seasons, continues to grow in favor with the public and is being put to a broader and more comprehensive use than ever before. As a matter of information to the individual farmer it is of great benefit because it informs him regarding farm work and the condition of crops in other localities. It, in a way, is an advertisement for the State of Michigan because it gives weekly a summary for each county of the various crops grown there. When used in connection with the statistical reports issued by the Secretary of State's office, it is of great value to buyers of all kinds of farm products. The Secretary of State's office furnishes the acreage and the previous year's production of all the staple products by counties. The Weekly Bulletin issued by the weather service gives the current condition of all staple crops and together they point out to the buyer where the best buying can be done.

The monthly and annual publications are published in the same style and form that has been followed for some years back. The data is all displayed in detail and tabulated homogeneously with the reports published in other states of the Union so that the climate can be readily compared with any other part of the country. These reports have a good circulation and are widely sought for.

The distribution of the daily forecasts is being rapidly forwarded by the rural telephone lines, which are rapidly spreading out over the State. Our present scheme is to telegraph the daily forecast at Government expense to the exchange centers of these rural telephone companies on their guarantee to disseminate them regularly, promptly and impartially to their rural patrons. This enables us to get our forecasts before a large number of farmers before noon, the forecast covering the period of "tonight and tomorrow." The telephone exchanges, as a rule, have been very

glad to enter into this agreement as it makes their telephones of greater benefit to the farmer and on the other hand it helps the weather bureau because it forwards the dissemination of its forecasts and warnings to the farmer. Our forecasts are now displayed in almost every postoffice lobby in the State; besides this they are sent out over a number of rural mail routes. The rural mail route, however, has so far been a disappointing medium in the dissemination of the forecasts because most of the rural mail carriers leave their home offices between seven and eight in the morning and the official forecast is not issued until about 9:30 a. m.

The instrumental equipment of the various observation stations remains in good condition and is complete at every station. The cost of replacing broken thermometers and keeping the remaining paraphernalia is considerable, but has been accomplished.

Toward the close of the fiscal year the chief of the U. S. Weather Bureau directed the discontinuance of the two regular weather bureau stations at Lansing and Grand Haven and the establishment in place thereof of a new station at Grand Rapids. This necessitated removing the head-quarter office of the Michigan weather service to the latter place because the director of the service was ordered to assume the charge of the new station. The change was accomplished on June 30.

Very respectfully,

C. F. SCHNEIDER,
Section Director.

SIXTEENTH ANNUAL REPORT
OF THE
EXPERIMENT STATION
OF THE
STATE AGRICULTURAL COLLEGE OF MICHIGAN
UNDER THE HATCH ACT
FOR THE
YEAR ENDING JUNE 30, 1903.

For members and organization of the State Board of Agriculture in charge of the Station and list of officers, see page nine of this volume.

EXPERIMENT STATION.

REPORT OF SECRETARY AND TREASURER.

The following account shows the receipts and expenditures of the Experiment Station for the year ending June 30, 1903:

	Cr.	Dr.
July 1, 1903—To balance on hand.....	\$2,225 47	
July 10, 1902 received from U. S. Treasury.....	3,750 00	
Oct. 10, 1902 received from U. S. Treasury.....	3,750 00	
Jan. 8, 1903 received from U. S. Treasury.....	3,750 00	
April 7, 1903 received from U. S. Treasury.....	3,750 00	
June 30, 1903 license fees on 106 brands commercial fertilizers	2,120 00	
miscellaneous receipts	11 77	
farm receipts	2,681 10	
from State appropriation, So. Haven. from State appropriation for U. P. Experiment Station	2,000 00 3,000 00	
U. P. Experiment Station, receipts South Haven Experiment Station receipts	587 45	
June 30, 1903—By disbursements as per vouchers filed in the office of the State Auditor Gen- eral		\$25,198 11
July 1, 1902 balance on hand.....		2,427 68
	<u>\$27,625 79</u>	<u>\$27,625 79</u>

From thirty-five to forty thousand copies of station bulletins are now issued, and the demand is increasing as farmers learn of their value. Several press bulletins have been issued and special information in bulletin form has been sent out by the station.

DISBURSEMENTS ON ACCOUNT OF U. S. APPROPRIATION.

Salaries		
Director and administrative officers, No. employed 6..	\$1,256 55	
Scientific staff, No. employed 7.....	4,372 71	
Assistants to scientific staff, No. employed 3.....	734 80	
		\$6,364 06
Labor:		
Monthly employes, 2; average rate, \$38.67.....	\$928 03	
Daily and hourly employes.....	2,043 94	
		2,971 97
Publications:		
Half tones, mailing list, etc.....	\$58 25	
Bulletin envelopes and reports.....	128 04	
		186 29
Carried forward		\$9,522 32

STATE BOARD OF AGRICULTURE.

Brought forward		\$9,522 32
Chemicals:		
Chemical supplies		107 35
Seeds, plants and sundry supplies:		
Agricultural	\$224 73	
Horticultural	44 14	379 26
Miscellaneous	110 39	
Tools, implements and machinery:		
Repairs	\$9 79	
New purchases	75 10	84 89
Furniture and fixtures:		
One roll top desk	\$35 60	
One bookcase	14 89	
One desk	24 00	
Sundry fixtures	9 17	83 66
Scientific apparatus:		
One objection	\$26 00	
Sundry items	848 24	874 24
Live stock:		
Cattle	\$1,206 65	
Sheep	151 80	
Swine	202 85	
Sundries	10 25	1,571 55
Traveling expenses:		
In supervision of station work	\$145 04	
For other purposes connected with station work	245 01	390 05
Building and repairs		495 16
Postage and stationery		307 64
Freight and express		312 82
Feeding stuffs		499 93
Library		359 37
Fertilizers		3 28
Contingent expenses		8 48
Total		<u>\$15,000 00</u>

DISBURSEMENTS OF EXPERIMENT STATION—MONEYS OTHER THAN RECEIVED FROM UNITED STATES TREASURER.

Salaries	\$2,489 45	
Labor	3,879 32	
Publications	5 65	
Postage and stationery	173 64	
Freight and express	138 38	
Heat, light and water	29 32	
Chemical	102 05	
Seeds, plants and sundry supplies	922 17	
Fertilizer	49 32	
Library	1 02	
Tools, implements and machinery	139 36	
Furniture and fixtures	15 44	
Scientific apparatus	118 97	
Building and repairs	1,678 20	
Traveling expenses	295 12	
Live stock		
Feeding stuffs	89 03	
Contingent expenses	71 67	
Balance on hand		\$10,208 11
Total		<u>2,427 68</u>
Total		<u>\$12,635 79</u>

REPORT OF THE DIRECTOR.

To the President:

During the year ending June 30, 1903, there have been issued by the Experiment station the following bulletins:

No.	Title.	Author.	Department.	Pages.
203	Analyses of some commercial feeding stuffs.....	F. W. Robison.....	Chemical.....	11
204	Mosquitoes and other insects of the year 1902.....	R. H. Pettit.....	Entomological.....	9
205	Report of South Haven substation.....	T. A. Farrand.....	Horticultural.....	30
206	Notes on small fruits.....	M. L. Dean.....	Horticultural.....	10
207	Sugar beet experiments, 1902.....	C. D. Smith.....	Agricultural.....	15
208	Michigan mushrooms.....	B. O. Longyear.....	Botanical.....	25
209	Notes on vegetables and bush fruits.....	L. R. Taft and M. L. Dean.....	Horticultural.....	20
210	Fertilizer analyses.....	F. W. Robison.....	Chemical.....	23
Special bulletins:				
17	Mosquitoes and other insects of the year 1902.....	R. H. Pettit.....	Entomological.....	26
18	Sugar beets in the upper peninsula.....	C. D. Smith & L. M. Gelsmar.....	Agricultural.....	8
19	Spraying calendar.....	L. R. Taft.....	Horticultural.....	

The mailing list of the station has grown rapidly until at the date of this report it includes the names of nearly forty thousand readers. The list is revised frequently to prevent the accumulation of names of people who, by reason of removal or otherwise, no longer care for our publications.

The size of this mailing list makes the cost of publication of the regular bulletins a strain upon the resources of the college. For this reason it is the present policy to print as special bulletins those articles which are interesting and valuable to certain sections of the State only. A resume of such articles appears in the regular bulletins, but the details are printed in the special bulletins alone. Again as the work of the station becomes more technical, it follows that the relative number of the special bulletins will increase. We welcome all farmers to our list of readers and shall try to furnish each one of them with the bulletins he desires.

The well established policy of the station has been followed as to the kind of matter to go into the station bulletins. The pages have been reserved for reports of results of experiments of observations made and have not been given up to matters purely educational. It is recognized as the limited sphere of the station publication thus to report work performed and to leave to the agricultural press the dissemination of information not immediately related to the experiments.

The bulletins are printed by the college without charge to the regular station funds.

It is my sad duty to record here the simple fact of the death of the man who has been from its inception, the chemist of the station. This is not the time nor place to review his work in detail nor to write an eulogy upon his personality. I must leave that duty to others. I cannot

refrain, however, from recognizing briefly what the relation of Dr. Kedzie to the experimental work of the college was and what it meant to the great State of Michigan.

Long before the Hatch act of 1887 gave to the college sufficient funds to well equip laboratories and provide specialists to carry forward experimental work, Dr. Kedzie was actively engaged in studying problems of consequence and of pressing importance to the citizens of his state. The results of his investigations were so apt and striking that they brought about legislation for the protection of life and limb and worked almost a revolution in the methods of farming in certain sections of the State. He secured a law relating to the quality of kerosene to be sold for illuminating purposes and suggested both the standards and the methods of testing and again he analyzed fertilizers and boldly denounced the fraudulent goods foisted upon the then unprotected public. He was one of the first to take up sanitary matters with the State Board of Health and at the same time, through the meetings of farmers and through the rural press was urging upon farmers better care of their barnyard manure and better methods of tilling. No phase of farm or urban life escaped the helpful influence of his life.

As a co-worker in the station he was resourceful, ready with helpful suggestions, cogent and inspiring in personality, always ready to cooperate in any good work, wise, far seeing and alert in selecting lines of investigation, thorough, yet quick in methods of work and courageous to the last degree in announcing and standing by conclusions once carefully obtained.

The value of his life to the State at large is beyond computation. Not only did he prevent fraud while he lived and provide continuing means for the detection of fraud and prevention of imposition after his death but by his investigations, by his teachings to the young men coming to his beloved college, by his piquant and cogent books and articles in magazines, newspapers and pamphlets and by his strong, vigorous, upright private life, led the people of the State into a clearer intellectual atmosphere, better business methods, and a more generous and fruitful relation to each other and to the State.

Professor Frank S. Kedzie had for years performed much of the chemical work of the experiment station but after the death of Dr. Kedzie he found himself burdened with the teaching and laboratory work of the large college classes. He was therefore made associate chemist of the station, and devotes whatever time is possible to the study of definite problems relating to rural life or practical field or stock management.

Professor F. W. Robison had been the assistant chemist and was, after the death of Dr. Kedzie, promoted to be chemist of the station and member of the council.

Professor C. F. Wheeler, the long time botanist of the station, was called during the year, to Washington to serve the Department of Agriculture. His work with the station bore fruit, not so much through the bulletins as through answers to questions and consultations with farmers and fruit growers in their own homes. Whenever and wherever there was an outbreak of plant diseases ruinous to crops, there Professor Wheeler went to give advice and suggest means of combatting the disease. His work was invaluable in this direction, and cannot be measured in dollars and cents. Again, he spent much time in testing and examining seed for purity and vitality. Beet seed, clover seed, grass seed of all

kinds came to him for examination and his prompt replies saved many a farmer from money loss or the purchase of seed which would introduce weeds upon his farm. His singularly accurate and broad knowledge of systematic botany was placed at the service of the State by his innumerable answers to questions relating to samples of weeds and useful plants sent in to him, either in the way of identifying the samples or telling the inquirer as to their characteristics and value.

Professor B. O. Longyear was chosen as his successor. His report follows and exhibits the scope of the present work of the Botanical division of the Station.

Some notable changes have taken place in the equipment of the Station during the year. A barn for the Bacteriological department has been built at no small expense. This barn is arranged for the isolation and care of animals afflicted with dangerous and infectious diseases and is provided with all the conveniences and requisites to insure the safety of other animals and of men. In the new College Bacteriological building there is a room set apart for the exclusive use of the Station and the laboratory and fixtures have been moved into it from the rooms over the Veterinary lecture room and offices. This laboratory is equipped with the apparatus necessary for the study of soil problems as well as those relating to animal diseases and an assistant is employed who devotes his entire time to soil life, especially the microorganisms resident in the nodules of the roots of legumes. Within the year also the Chemical department has moved its quarters into the rooms vacated by the Bacteriologist in the Veterinary building where a new laboratory has been fitted up. The College Chemical Laboratory is altogether too small to accommodate the large and increasing classes and this move was made to aid in relieving the pressure for room in that building.

The Entomologist has erected a small house for conducting experiments in fumigation. Certain crops, notably those in greenhouses are threatened by diseases which yield to no treatment other than fumigation with gases so dangerous to human life as to require specially constructed buildings for their use.

The report of the Superintendent of the Upper Peninsula Experiment Station shows that while the year 1901 was exceedingly wet and as a consequence the crops were either ruined while growing or were rendered valueless by wet harvests, the season of 1902 was comparatively dry, allowing the Station fields to show crops that would do credit to the most fertile sections of the Southern Peninsula. As far as the work has gone it seems to indicate that the chief difficulty, which farmers in the Northern Peninsula will experience, comes from frosts late in the spring and early in the fall. While it is hoped that the removal of the forests will remedy this difficulty to some extent, there is a lack of definite proof that immunity from summer frosts is to follow the clearing of lands. The location of the Station is unfortunate, perhaps, in the matter of rainfall. The records show that the region about Chatham is one of the sections of the State in which the rainfall is greatest. The superabundant rainfall and the summer frosts have made the growing of tender vegetables and fruits exceedingly difficult and precarious. There are no permanent improvements to be recorded at this Station during the year, except grading about the house and barn and clearing off the first terrace above the creek on the north side.

At South Haven the fruit trees are now in full bearing and the report of the Superintendent and Professor Taft shows in how many ways the State derives benefit from the present and past work of the Station.

The reports of the several divisions of the Station work filed herewith and made a part of this report will set forth the work accomplished and planned. They need little comment from me. Heretofore the work of the Horticulturist has been devoted largely to variety tests of fruits and vegetables. It is hoped that there may be a radical change in this respect in the immediate future. While variety tests have a certain value, the time has come when a scheme for more important lines of work should be adopted. The South Haven Station now has fruit trees in full bearing and the time of its greatest usefulness has but just begun. In the Upper Peninsula the questions to be solved for the fruit growers are rather what can we grow with hope of profit than a study of new principles and better methods.

Attention is called to the work of the Chemist in the matter of digestion experiments and analyses of breakfast foods and commercial feeding stuffs. The whole question of digestibility and its relation to actual food values is still in the dark and it is the hope of the Chemist to furnish a little data to aid in clearing up present uncertainties. In the matter of breakfast foods, the American public has been led into many errors. While nearly or quite all of them have merit and are valuable additions to our lists of available and easily prepared table supplies, they do not possess the miraculous powers ascribed to some of them by the ardent and sometimes unscrupulous advertisers. The truth concerning these foods will be brought out and published in due time. In relation to commercial feeding stuffs for domestic animals also the work of the chemist is of great value. One bulletin has been published already and the work in this direction is far from complete. Legislation is sorely needed to protect Michigan consumers from fraud.

The Veterinarian has presented to him certain problems of unique importance. The presence of a widespread disease among the cattle of a great section of the northern part of the lower peninsula calls for investigation. The State Live Stock Sanitary Commission has initiated a study of the disease by bringing to the College several animals afflicted for study. The symptoms of the disease in question are those of starvation and recovery seems to follow immediately on the ingestion of proper food. Another problem of great importance to sheep feeders relates to the parasitic diseases of lambs and wethers put up for fattening. The Veterinarian has carried forward one set of experiments with this class of animals but the results are held for confirmation.

The time of the Bacteriologist has been taken up with planning the new laboratory and moving into it. He has therefore little new work to report. He has spent the last part of the year in Europe and will return in the fall prepared to do still better service in advancing our knowledge of bacteriology in its application to soils, live stock, and the home.

The report of the Entomologist discloses fully and accurately the lines of work he has undertaken and the results.

The experiments with live stock have been limited to the feeding of a carload of steers and a study of the feeding capacities of sheep and goats. Dried beet pulp was fed to good advantage to certain pens of lambs and its value indicated. The steers also received raw pulp and gave a good account of it.

The field work of the Station has been limited by the fact that at best the soil is far from homogeneous and has been used for fertilizers and other experiments so many years that there remains no place on the College farm to try any plot experiments whatever in which the value of the results is based upon the comparisons of yields of adjacent similar plots. In one case where a series of plots were planted alike in every respect as far as it is possible to observe, the differences in yields of adjacent plots were greater than in another series of similar plots where one factor was varied. It is, therefore, impossible to tell whether a difference in results is due to a known difference in conditions or to a lack of homogeneity in the soil itself.

Remembering these limitations the work at the home Station was confined to the following lines of experiments:

I. Experiments in cooperation with the several divisions of the Department of Agriculture.

(a) *Sugar Beets*.—Mother beets were grown on the farm of Mr. M. D. Picket, south of Okemos, from seed furnished by the department. The individual beets to be reserved for planting in 1903 were selected first on the basis of conformity to a fixed standard of shape and size of top. The expert sent from Washington aided in deciding what this standard should be and aided also in outlining the method of applying the standard to the work of selection. Next the form and size of beet root was considered and all mother beets rejected which did not have a smooth and typical shape. Finally, on removal from the pits in which they were stored during the winter the beets were tested by boring out a cylindrical core through the center and analyzing the part removed.

Each step in the selection culled out a good per cent of the beets and there remained but a relatively small number to be set out in the spring of 1903. These selected mother beets were planted in one of the Station plots of the College farm in April, 1903, and at the date of this report are in vigorous health and show a full stand of blossoms. A consignment of seed from Washington received in the spring of 1903 is sown to carry forward the study of the problem of beet seed production in America.

A second cooperative experiment with sugar beets relates to the prevention of leaf blight by fertilizing and by spraying. The use of nitrate of soda is suggested by the well observed fact that vigorous plants are more resistant to disease than weaker ones. Whether these or other fertilizers will aid in reducing the devastations of the blight remains to be seen.

Certain plots are sprayed at specified intervals with Bordeaux mixture. The season of 1902 was so wet that the results were purely negative.

A third experiment with beets carried forward with the Department of Agriculture at Washington related to the influence of environment on the quality of the beet. This work is reported by the department and published in the bulletins issued by the Division of Chemistry.

(b) Grass seed has been furnished by the Division of Agrostology and in cooperation with that division has been sown at several points along the west coast with the hope of staying the encroachment of sand upon the agricultural land. It is too early to report results.

(c) The Department of Agriculture furnished in the spring of 1903 the seed of certain legumes, notably a small bean of *Arabia* to be used as human food, and selected varieties of cow peas and soy beans to be used as forage crops or for green manure.

(d) The Station is carrying forward in cooperation with the Division

of Chemistry an experiment on the influence of certain fertilizers and certain crops on the fertility of the soil. This work has gone forward for the past two years and results will be published in the winter of 1903.

(e) For three years the Station has been cooperating with the Department of Agriculture in determining the relative value of home grown and foreign clover seeds. As a net result it is safe to report that the largest yields invariably come from American grown seed; next from the seed of northern Europe, while the seed from southern Hungary and Italy produces plants so weak as to succumb to *geosporum* and other diseases.

II. *Sand Lucern*.—The plots sown to this valuable legume still maintain a good stand. Early in 1903 it was harrowed rather severely and more seed sown. Unfortunately, in 1901 the west rod of the plot was left for seed and was not cut at all. No seed appeared, although there was an abundance of blossoms. In the spring of 1902 there was a heavy mat of dead tops on the ground which were raked up and hauled off early to prevent smothering the living plants. The stand seemed to be injured by this treatment although by the 14th of May there was a growth eight inches high and promising half a crop. It must be remembered that this same area had been pastured in 1900 and the pasturing may have aided in the injury to the crop.

The next strip east a rod wide was cut once in 1901 and then left for seed. No seed appeared on this area but the crop was not harvested in the fall of 1901. It was noted in 1902 that the stand was much better and the plants much thicker on the ground than on the plot next west which had not been cut at all in 1901.

A strip a rod wide next east was cut twice in 1901 and left for seed. Here the stand was good in 1902 and remains good in 1903. Frosts on the evening of May 13th did not seriously affect the sand lucern, although it blackened some of the tender leaves. The same frosts materially injured clover on adjacent plots. In 1902 the sand lucern was cut three times, viz.: June 4th, July 21st, and August 5th. Yields of dry hay were as follows:

	Yields per plot.	Yields per acre.
June 4	2,591 lbs.	4,318 lbs.
July 21	2,830 lbs.	4,716 lbs.
August 5	1,800 lbs.	3,000 lbs.

III. The recent investigations concerning the relation of soils to crop production go far to convince experimenters that the available fertility of a given soil cannot be measured by chemical analysis. Other factors enter into the matter which seem to be of equal importance. The presence of humus, for instance, and the microscopic life of the soil are of prime importance in determining its fertility.

Our experiments have been largely devoted to a study of unusual legumes. A bulletin is ready for publication but is withheld for confirmation by larger plots. Vetches are new to Michigan and our study to date show that under the name of "hairy vetch" various species of the vetch are sold, some of which are useful for the production of seed and some for the production of forage only. The farmer has no indication as to which kind he is getting. The matter is, therefore, being carefully investigated for a bulletin to appear in the autumn of 1903. There

will be set forth the characteristics of the dozen or more different species of vetches so that when the farmer wants to get one especially adapted to the production of forage he will know which species to buy.

Cow peas are not new to Michigan but the farmers are not yet advised as to which sort to select or which method to adopt in growing them. These matters are being investigated on a large scale by the Station. Similar lines of work are going forward in relation to soy beans. It is a question whether the other newer legumes related to the lathyrus on the one hand or to astragalus and san foin on the other will ever be important items in a Michigan rotation.

IV. The work with cereals was practically ruined by sparrows. Professor Jeffrey has succeeded in developing oats of superior merit by selecting individual plants to get productivity. A similar line of work was undertaken with wheat by the Experiment Station, when, unfortunately, the sparrows discovered the superior merits of the wheat growing on the Station plots and harvested the crop without leaving a record of the yields. In 1903 the sparrows have not waited for the crop to mature but foreclosed their claims while the grain is still in the milk. This pest of English sparrows has rendered impossible the carrying forward of experiments with wheat and that line of work is temporarily abandoned.

With oats the question considered related to the date of sowing. The results are reserved to compile with those of the present year. Corn and legumes were planted together to compare the value of cow peas, soy beans and two sorts of field beans, viz.: the Southern Prolific and Red Speckled. The results indicate that either of the varieties of field beans were better for planting with corn than the cow peas or soy beans. The Experiment Station of Illinois kindly donated to this Station seed corn, half of it high in protein, the other half low in protein. The season of 1902 was adverse to corn growing and neither sort matured.

V. The experiments on muck were continued, the results emphasizing the conclusion already published in regard to the best fertilizer for that class of soils. Nothing approaches barnyard manure as a fertilizer for muck lands; the potash fertilizers are all good and show beneficial results but barnyard manure is incomparably superior and the plots receiving it can be easily noted by the greater yield and more luxuriant growth. This is true of all classes of plants whether legumes, cereals or other crops.

VI. Sugar Beets: Besides experiments carried forward in cooperation with the Department of Agriculture in sugar beets the Station has performed some experiments of its own of considerable importance to the State. In the first place, the work with beets and other crops testing the influence of three successive crops of beets on the same field is interesting. Through the center of a certain field a strip was planted to beets for three years and in 1902 the whole field was planted to oats, corn and beets, in strips crossing the area which had been planted to beets for three years. It was shown that this successive use of the beet crop had seriously impaired the ability of the soil to grow either beets or other crops. The per cent of damage of course cannot be estimated but the fact of serious injury is an important element in that experiment. In the second place an interesting result of another line of work was the indication that 20 inches to 22 inches apart of rows yields as large an amount of beets and as rich beets as 16 or 18 inches apart. Variety tests in sugar beets have not resulted in great good because the plots have been

small and the season bad. Fertilizer tests are continued in 1903 on fields away from the College farm for the reasons already stated.

VII. The work on the plots set aside in 1895 for rotation and fertilizer experiments is still kept up although according to the original plan no results for publication may be expected until 1905 when the series will be completed.

I am glad of an opportunity to express my appreciation and that of the council for the generous support accorded the Station by the President of the College, by the State Board of Agriculture and by other departments of the College. I am especially glad to report that the Department of Practical Agriculture has shown its kindly attitude by generously responding at every opportunity to aid the Station work. Professor Jeffrey has undertaken a study of the effects of the application of barnyard manures on the temperatures, the soluble salts and the life of the soil and is aided by the Bacteriological Department in the work. He is using several series of plots and important results may be expected.

I refer again to the several reports hereto attached and made part of this report and to the bulletins, copies of which are also attached and which are to be printed as part of this report.

Respectfully submitted,

C. D. SMITH,

Director.

Agricultural College, Mich.,
June 30, 1903.

ANNUAL REPORT OF THE DEPARTMENT OF ENTOMOLOGY OF THE EXPERIMENT STATION.

Professor C. D. Smith, Director:

Following is a brief report of the work done by the Department of Entomology during the year ending June 30, 1903.

Two bulletins have been issued during the season by this office, Special Bulletin No. 17, and a brief resume of the same, No. 204. The correspondence has continued to be quite an item in the routine work. One trip, in company with Professor Wheeler, was made to Detroit to investigate the cause of the death of hickories at Belle Isle. Recommendations were made for the restriction of the trouble.

A study of the mosquito problem was commenced and experiments for the eradication of the insects were made on quite an extended scale. In this work, the writer was allowed one-third of the time of Mr. Bronson Barlow, whose efficient field work made the experiment possible. The large amount of standing water and the exceptionally wet season, made it impossible to get rid of the mosquitos on the campus, although the petroleum oil acted perfectly where applied, killing the insects in the adolescent stages very readily. It was deemed advisable to wait one year before repeating the work in order to take advantage of drainage then contemplated. This spring, the woods behind number seven, or in other

words most of the river woods have been drained at trifling expense by this department and the Department of Forestry, by means of open ditches following, as far as possible, the natural outlets. These pools were extensive breeding places for mosquitoes and, as they lie to the south and east of the campus, the pests are driven in by the winds in great numbers. It also is probable that the pools in the vicinity of the athletic field will be drained during the summer, thus adding much tillable land to the farm on which they lie. This will take away considerable breeding space and render the work much easier next season.

The wet weather that prevailed during the season of 1902 and which seems about to be repeated this year, has made plant-lice numerous and kept the grasshoppers down. The Hessian fly is becoming less destructive as we are approaching the bottom of the wave of destructiveness. It is to be looked for again in a few years, however late sowing will retard the wave and render the next incursion less disastrous.

A disease of the California apricot scale has just been found working in our orchards and vineyards. It is hoped that it will be well established before long.

An accident to myself has rendered it impossible to do as much traveling as I should like, but I hope to be in better condition soon.

During the winter, the entomologist, at the request of Professor U. P. Hedrick, advised with him in relation to the spraying of the elms on the campus, and also kept the records of the applications and treatment as a whole. It may truthfully be said to have been a success, although the scales still exist in many places on the trees. It is utterly impossible to eradicate them in one or two years. Owing to wind conditions, many trees were sprayed on one side only, and in other cases, the spray of lime, salt and sulphur was found to be inefficient, owing probably to too long a time elapsing between the preparation and application of the spray. At the same time, the trees have been greatly benefited as can readily be seen, and probably they will show still greater improvement later in the season. Lime, salt and sulphur is said to be very slow in its action while fairly certain in its results.

An extended experiment bearing on the question of broods and time for spraying for the codling moth has been started. It has required and will require from now on, a great deal of field work, but the question is of such interest that it is deemed time and labor well expended. It is expected that the time of egg laying for the second brood may be determined and possibly the existence or absence of the third brood may be demonstrated.

A fumigation house has been built for the purpose of experimenting with hydrocyanic acid gas in the control of forcing-house pests as well as the pests of roses, carnations, chrysanthemums, etc. Little has been done along this line, and the writer is constantly asked for information relative to the control of mealy bugs in cucumber houses, etc. This house and its accessories furnishes a complete outfit for the fumigation of nursery stock, cuttings, etc.

Several oily compounds are at hand which are to be tested comparatively for their effects on mosquitoes.

The work on scale insects of the more difficult species is going on as opportunity offers. The reason for this work, being little understood, it may be of interest to some to know that the identity of many of the fleshy scales can at the present time merely be guessed at. Their charac-

teristics are so obscure and so ill defined that experiments in their control are constantly rendered negative. The experimenter, in perfect good faith sprays what he believes to be one scale when he in reality has something else, perhaps possessing very different powers of resistance. The experiences of different fruit growers disagree because they are really working against several different insects, believing them to be the same. This applies to the fleshy scales only in our State and while some of them are now recognizable, many are not. It is also desirable to know the list of host plants on which each will work.

The time has now come when one man, on half time, cannot do all of the work alone. Last year, during the summer, Mr. Bronson Barlow was employed for one-third of his time by this office, and this summer Mr. Tuttle will find work for part or all of his time. The quarters are inadequate to the performance of efficient work, it being necessary to put away apparatus and books between classes and whenever the laboratory is required for other work. A great deal of time is taken up in setting out materials and putting them away again after an hour or two of work. Another larger room even in another building would make it possible to accomplish a great deal more.

Respectfully submitted,

R. H. PETTIT,

Entomologist.

REPORT OF THE HORTICULTURIST.

Prof. C. D. Smith, Director:

Since July 1, 1902, only a small portion of my time has been devoted to the horticultural work of the Experiment Station, my duties as Superintendent of the Farmers' Institutes and as State Inspector of Nurseries and Orchards having taken the larger portion. The work of caring for the experimental crops and carrying out the experiments has been performed under the direction of Prof. U. P. Hedrick, the Superintendent of the Horticultural Department of the College. M. L. Dean, the Assistant Horticulturist, has had charge of the experiments and looked after the taking of notes.

At South Haven the work has continued in charge of T. A. Farrand, who has proved an excellent manager. The results secured from the various experimental work carried on there were given to the public during the early spring in a bulletin prepared by him. The trees and bush fruits came through the winter in good condition and although much injury was done to Japan plums, sweet cherries and other fruits by the frosts during the early part of May of this year, the trees upon the Station grounds escaped with very little injury and all promise at least a fair crop, while many will need careful thinning.

Some three or four years ago the testing of strawberries at this station was discontinued as there was no ground available for the purpose. This spring, however, the work was again taken up and a small plantation containing all of the more promising sorts was made. If a considerable tract of land in the vicinity of the Station grounds can be

secured for planting next year it is proposed to continue the work on a somewhat larger scale. The work will not only include the testing of new kinds but will take up different methods of handling the plantation and a comparative trial of commercial fertilizers and stable manure.

During the spring the peach trees at South Haven have shown in a striking manner the effect of spraying for the leaf-curl. While many of the varieties in neighboring orchards were seriously injured by this disease, as were a number of trees left unsprayed in the Station orchard, the trees that received an application of copper sulphate solution with two pounds in fifty gallons of water had practically no curled leaves upon them. This corresponds with the results secured in previous years. Several reports have been received indicating that the treatment has not been equally successful in all cases, but it would seem that this must be due to the fact that the work was not thoroughly performed. From the nature of the disease, it is evident that in order to be effectual, every bud upon the trees must be soaked with the solution.

POWER SPRAYING MACHINERY.

For several years inquiries have been received regarding power spraying machinery for large orchards. Some years ago tests were made of spraying machinery by which power for the working of the pump was supplied from the wheels of the wagon, but this was not found entirely satisfactory. This spring a test was made of a gasoline engine for this purpose. The kind used was the National, which is manufactured by the National Engineering Co., Saginaw, Mich. This company has made a study of the subject and furnished us for trial a combined engine and pump upon one base. The cylinder and working parts of the pump are of Tobin bronze, which adapts it for use with Bordeaux mixture and copper sulphate solutions. The engine is one and one-half horse power and, by means of the relief valve set at 110 pounds, it is possible to return any surplus material to the tank and, at the same time, keep the liquid thoroughly agitated. The pump is designed to carry from two to four lines of hose and with a pressure of from a hundred to one hundred ten pounds is able, with Vermorel nozzles, to produce the very finest kind of mist. As compared with an ordinary hand pump, where the pressure usually varies from fifty to seventy-five pounds, the difference in the spray produced is very marked.

The cost of gasoline for running the engine varies from fifteen to twenty-five cents per day according to the amount of time consumed in filling the tank and the number of streams carried. The engine will not only do the work of one man but it will be done in a far better manner and at less than one-sixth the expense. An engine and pump, such as has been described, with bronze working parts and other equipment in the way of tank, hose, nozzles, etc., costs about \$250. While a small orchardist cannot afford such an outfit, the owner of a large orchard will find it economical, as it will do the work performed by three ordinary barrel outfits and thus will be able to pay for itself in one or two seasons.

DUST SPRAYERS.

Some fifteen years ago we tested a number of "powder guns" for applying insecticides in a dry form. For many insects that attack vegetables and bush fruits they were found quite effectual if used while the dew was

upon the foliage, but with the development of liquid spraying machinery they were not deemed economical for tree fruits. Recently several companies have perfected large and powerful machines for the application of insecticides and fungicides in powder form. As strong claims are made for them and much interest is being shown by fruit growers, we are again giving the matter a thorough trial. The materials used are lime, copper sulphate and sulphur, with the addition of concentrated lye where sucking insects are present. The lime is first dry-slacked with strong solutions of copper sulphate and lye and the sulphur is then added.

It is too early as yet to make any definite report upon the results secured. The cost of material is considerably less than for Bordeaux mixture and Paris green, owing to the fact that a comparatively small amount of copper sulphate is used in the dust sprays. The application of dust can be made in about one-half the time required with an ordinary barrel pump but this is largely counterbalanced by the fact that the application of the dust spray must be more frequent than that of the liquid sprays. The use of the dust spray has many advantages upon land that is uneven and where a supply of water cannot be readily secured.

COOPERATIVE EXPERIMENTS.

During the year the plan of checking the results obtained at the Station by means of similar experiments carried on at different parts of the State has been continued. In the fall arrangements were made for testing various cover crops in the Station orchards at the College and at South Haven, and upon the farm of Benton Gebhart at Hart, Oceana county, and on that of W. W. Dickinson at Carl, Berrien county. For the most part the results secured were quite similar. The seed was sown during the first half of August and as the weather was quite cool, it was no surprise to have the poorest results secured from cow peas and soy beans. They made a slow start and small growth and were then cut by frost. These crops, however, have given fairly good results when sown during the month of June, when the weather is warm and fairly dry. The plots upon which flat turnips and rape were sown did fairly well. The rape reached a height of eighteen inches and served a good purpose in holding the snow and leaves being rather better for this than the flat turnips. The oats started very evenly and gave a thick, strong growth, reaching a height of about twenty inches. They form an excellent cover crop during the winter and in the spring serve as a mulch to hold the moisture and keep down the weeds. The barley also made a good growth and by Mr. Gebhart was thought superior to oats. The plots sown to Canada field peas gave comparatively poor results. The vines mildewed badly and made but a weak growth. The results obtained from buckwheat were also rather disappointing.

Mammoth and crimson clover gave about equally good results. At the College a very good stand of each was secured and the plants came through the winter in good condition. In the spring they started early and soon reached a height of from fifteen to eighteen inches. As soon as they were well in blossom the plants were turned under and furnished a large amount of humus. Altogether less valuable as a winter cover crop, owing to its spreading habit which does not favor the holding of snow and leaves, the hairy vetch at all places where it was tried gave good satisfaction. The plants interlaced forming a regular tangle. When

straightened up the plants would stretch to a height of four or five feet. The principal difficulty found with it is that the growth is so strong that it is difficult to turn it under with a plow. It can be done by using a sharp rolling coulter or by first chipping it up by the disc or cutaway harrow. Not only does this crop supply a large amount of humus but, judging from the tubercles upon its roots, it is evident that it must take a large amount of nitrogen from the air.

For a number of years we have tested the effect of oats when used as a sort of nurse crop and last fall oats were sown at the rate of three pecks to the acre across one-half of each of the above plots. In previous years the results have not been very satisfactory, as the crops tested have generally given better results when used alone than when sown in combination with oats. This year the quantity of oats sown was reduced one-half. It is to this, as well as to the fact that the season was comparatively favorable for most of the crops, that the difference can be attributed. This year the clover and other crops sown with the oats gave fully as good and generally a better stand than when sown by themselves.

The comparative spraying operations have also been continued. Last fall the results secured were very satisfactory. Where apple orchards had been given three applications of Bordeaux mixture with arsenic or Paris green, very little scab and almost no apple worms were found. In a number of cases the trees had been greatly injured by the canker worms but after two thorough sprayings they disappeared and no trace of their work could be found upon the trees.

Cooperative fertilizer experiments were also undertaken, but little or no result was obtained either in the growth of trees or the character of the fruit. The applications were made both upon sod and cultivated orchards. The stable manure produced a noticeable effect upon the growth of the grass and a similar but less marked effect was noticed where commercial fertilizers were used.

During the spring a collection containing ten varieties of apple trees and ten of the newer sorts of potatoes were sent for trial to some twenty-five counties and placed in the hands of the secretaries of the county institute societies to be tested and the results to be reported at the institutes.

This work was commenced some fifteen years ago and many of the trees are now in bearing. The larger portion of the first lot of trees sent out were peaches and most of these were destroyed in the severe winter of five years ago. A large number of varieties of Russian apples were sent out between 1899 and 1895. They were distributed for the most part in the northern part of the State and have proved quite hardy and many of them are very desirable varieties for that section.

STATION ORCHARDS.

A considerable number of the young apple trees of the Station orchards bore for the first time this year. While it will require further trial to determine their value as commercial sorts, many of them seem quite promising, especially for home use. The cherry and pear orchards have also reached a bearing age but, while a number of kinds are fairly promising, there are very few that will be likely to supercede the standard sorts. A large number of the Japan plum trees have also borne. Red June and Wickson together with the older Burbank and Abundant are worthy of

planting for commercial purposes. Of the comparatively new European plums, Lincoln, Giant Prune, Grand Duke, Black Diamond and Monarch are very promising as market sorts.

A considerable amount of work with garden vegetables and small fruit has been done during the present year and the results published in bulletin form.

L. R. TAFT,
Horticulturist.

Agricultural College, Michigan,
June 30, 1903.

REPORT OF THE DEPARTMENT OF AGRICULTURE.

To Director C. D. Smith:

The following is a brief account of the work done in live stock experimentation since September 15, 1902.

BEEF CATTLE.

On October 23, 1902, twenty-four steers consisting of eighteen Short-horn and six Hereford grades were purchased at the Union Stock Yards, Chicago, for experimental feeding purposes. The experiment in which they were used was the third of a series, the object being to determine the most profitable form in which to use the corn product in beef making, and also to secure data relating to the use of beet pulp for the same purpose. These steers were divided into four lots of six each after having undergone a preliminary test to secure some indications of the relative performance of the individuals. The different forms in which the corn product was fed were as follows, viz.: (1) Ensilage. (2) Corn-and-cob meal and stover. (3) Shock corn. These materials were secured from areas of equal size which had produced a uniform growth.

DAIRY CATTLE.

Since January 1, 1903, investigations have been in progress along the following lines:

- (1) The use of various rations as regards economic production.
- (2) Results from the use of light or heavy grain rations.
- (3) Effect of alfalfa on quality of milk where substituted for clover.
- (4) Supplementing pasture with ensilage instead of grass.

SHEEP.

Experiment with dry beet pulp for fattening sheep. On January 9, 1903, thirty western wethers and twenty lambs were put on feed in which dry beet pulp was one of the foods used. The wethers were divided into two lots of fifteen each. During the test proper lot 1 received clover hay and a grain ration consisting of corn 4, bran 2, oil meal 1; and lot 2 received clover hay, a grain ration consisting of corn 4, bran 2, oil meal 1,

and dried beet pulp in addition. The lambs were divided into two equal lots and fed on rations the same as those supplied the wethers. In this case the dried beet pulp was fed along with a moderately heavy grain ration; we propose using it in connection with a light grain ration and also a substitute for some one food factor.

Ten acres of forage and soiling crops are now being grown for the use of the sheep.

SWINE.

Facilities for housing and experimental swine feeding are now about complete. In addition to remodeling the old hog house, ample yardage has been provided, so arranged that forage crops can be used. At the present time rape, succotash, field peas, cow peas, soy beans, sugar beets and permanent pasture are being grown. Our object in conducting this work will be to secure a succession of forage crops throughout the longest possible period.

ANGORA GOATS.

Late in December, 1902, thirty Angora wethers were purchased in Kansas City and fifteen kids in central Wisconsin. They were used to determine the feasibility of feeding Angoras during the winter season under similar conditions and with the same kinds of food used for sheep. We have since attempted to use some soiling crops. Plans are now about complete to use these animals for clearing brush land in the vicinity of the college. It seems desirable to continue the goat feeding during the coming winter under less artificial conditions.

Respectfully submitted,

R. S. SHAW,
Experimenter in Live Stock.

June 30, 1903.

REPORT OF THE CHEMIST.

Professor C. D. Smith, Director:

During the past year external evidences of the work of this division have shown themselves in the two bulletins issued. The first one published in December, 1902, entitled "Analyses of Some of the Commercial Feeding Stuffs of Michigan," is the first one of this nature ever published at this station and the rapidity with which the supply was exhausted proved that it was of considerable interest to the farmers and feeders of the State.

Many letters were received from feeders throughout the State affirming their desire to cooperate in the effort to expose the real condition of the feeding stuff market and many letters of approval were received after the bulletins had been distributed. I mention this simply to show that the live stock interests of the State are assuming such proportions that the station is compelled to use its facilities to disseminate information regarding the scientific and economic use of the concentrated feeding stuffs. It is highly desirable that a State law, regulating the sale of these feeds, be enacted.

The second bulletin from this division is somewhat similar to former annual bulletins on the "Analysis of Commercial Fertilizers." This bulletin takes all of the time of the chemist and an assistant from March 1st to July 1st. The inspections have heretofore been carried on entirely in the spring. It is our purpose to make a partial inspection in the fall and by so doing we hope to cover the fertilizer districts more thoroughly. The fertilizer interests of the State are in a healthy condition and the manufacturers are learning rapidly that under a rigid inspection and analysis it is to their highest interest to conform religiously to the law.

Michigan being the Mecca for breakfast foods, it has been considered desirable to undertake a study of the various brands upon the market and publish the results in bulletin form. This work was taken up last fall but is yet unfinished. The work will be continued again in July of this year.

An experiment in animal nutrition was undertaken at the beginning of January, 1903, bearing on the influence of a succulent feed on the various factors of digestibility in an otherwise dry ration. This work was taken up at this time because wet sugar beet pulp was most available at this time. The experiment covered three (3) months and some very valuable data was obtained—data of considerable significance scientifically, and in view of the seeming valuable work it has been deemed advisable to duplicate the experiment this fall. This work is of much value not only scientifically but practically for the agriculturalists of this State are each year giving greater attention to problems of animal production and nutrition.

An unusually large amount of miscellaneous analytical work has been done during the past year. Frequent are the requests from farmers, throughout the State, for information concerning fertilizers, soils, feeding stuffs, etc. It is the policy of this department to give such desired information whenever possible knowing that by doing so the station is

made more useful to the State. All this necessarily involves much routine work and this work is already reaching large proportions. The many problems in beet sugar production have necessitated a large number of analyses of sugar beets. This work is always immediate, and it many times causes other important work to be dropped temporarily.

During the past year the experiment station and particularly the division of chemistry has sustained a loss from which it will with exceeding difficulty recover. I refer to the death of Dr. Robert C. Kedzie, who has been at the head of this department since its birth. His work has been so intermingled with college and station affairs that it is impossible to think of either without the association bringing the life work of Dr. Kedzie to mind. But to eulogize him is a task for which I am entirely incompetent. To one who has had with me the esteemed honor and pleasure of a somewhat intimate acquaintance with him, Dr. Kedzie's death brings a keen sense of a personal loss.

The recommendations of the chemist have for years been made with the hope of providing better laboratory facilities for the experiment station division and conditions finally shaped themselves in a way that demanded some adjustment. To meet this requirement and to relieve as much as possible the over-crowded condition of the chemical department of the college the Board granted the upper part of the veterinary building for the use of the station laboratory. These rooms are now occupied by this division.

Undertaking as I have done to continue the work laid down by our revered Dr. Kedzie and realizing, to some extent at least, the meaning of it all I appreciate in no small degree the earnest support you have given me and I desire here to express my high appreciation of that support. I deem it a pleasure to acknowledge also my appreciation of the advice and counsel of Professor Frank S. Kedzie.

Very respectfully submitted,

June 30, 1903.

FLOYD W. ROBISON, Chemist.

REPORT OF DEPARTMENT OF BACTERIOLOGY AND HYGIENE.

Director C. D. Smith:

Owing to the disturbed conditions under which we have been laboring during the past year, I shall not be able to report much accomplished experimental work. My own time up to March 14th, when I sailed for Europe, was almost exclusively occupied with teaching and with matters connected with the construction of the new Bacteriological laboratory. So many details have to be considered in the building of a laboratory, which cannot be easily conveyed to those in charge of construction, that I felt it necessary, as well as desirable, to watch over them in their preparation. As I look back over the constructive work, I feel that my time was very profitably spent.

Although no experimental work of any consequence is to be placed to our credit during the past year, nevertheless we are now in better condition to carry on investigations. We feel gratified that the Board

has seen fit to provide us with such a good working laboratory with which to carry on our experimental work and we trust that the future will demonstrate the real value and great need of bacteriological research in connection with agricultural science.

I am pleased to report that Mr. Barlow has gotten nicely started with his work on plant and soil bacteriological problems. He, too, has suffered from the chaotic condition of our laboratory during the year and has not been able to carry out many of the plans which were formulated early in the fall.

Mr. Edwards' time has been fully occupied with instruction during the year, consequently he has had no time, as well as no opportunity, so far as laboratory facilities were concerned, to carry on any investigations.

I desire to express my thanks to both Mr. Edwards and Mr. Barlow in connection with the development of the new laboratory and facilities for carrying on research work as well as for their aid in making many tests during the year.

Most respectfully submitted,

CHARLES E. MARSHALL,
Bacteriologist.

June 30, 1903.

REPORT OF CONSULTING VETERINARIAN.

Director C. D. Smith:

As consulting veterinarian for the experiment station, I have the honor of presenting the following report:

Much of my work in this connection has been the answering of letters received with reference to the diseases of live stock. More letters have been received than in previous years, but as the inquiries have generally referred to various sporadic disorders, it does not indicate that disease is any more prevalent throughout the State than in previous years.

Many of these inquiries come from portions of the State where there are no qualified veterinarians, and we are thus able to supply information which in many cases the inquirers would be unable to get from any other source.

During the year some experimental work has been carried on with the internal parasitic diseases of sheep. The object sought for in the experiment, was to find some cheap remedy which could be administered, along with a grain ration, to the entire flock, more as a preventive than as a curative agent. Experience teaches that the parasites often become very numerous before the condition of the animal attracts attention, and before the parasites can be eliminated the constitution of the animal is so undermined that it will not rally, even though the remedies used are effectual in expelling the worms.

The work and expense necessary in treating a large flock by dosing each individual animal is so great that it will often be neglected entirely or poorly done, hence the necessity of a remedy that can be given in the feed to the entire flock. Such a remedy must be effectual, fairly cheap and one the animals will take.

While we are not as yet warranted, from work done during the past year, in saying that there is a remedy which can be used in the manner suggested, yet the results from the work, encourage us to believe that there is, and we hope during the next year, to test more thoroughly certain remedies and prove their efficiency, and be able to publish during the year something of value to sheep raisers.

Another disease which has caused considerable loss in some parts of the State is one known by a different name in different sections. Throughout the north it is generally called "Grand Traverse" disease; in the western part of the State the "Lake Shore" disease.

In connection with the Live Stock Sanitary Commission some work has been done in endeavoring to determine the cause and discover a remedy for the disorder. The disease seems to be a derangement of the digestive system, the exact cause of which has not as yet been determined. Some affected animals from Ottawa county which were brought to the experiment station some six weeks ago, have responded very nicely to treatment.

We hope to carry the experiment further by carrying out, as soon as the opportunity presents itself, the same line of treatment with cattle under the conditions in which they have been kept and under which they became affected.

We hope also, during the coming year, to present something definite with regard to this disease.

Respectfully submitted,

GEORGE A. WATERMAN,
Consulting Veterinarian.

Agricultural College, Mich.,
June 30, 1903.

REPORT OF BOTANIST.

Professor C. D. Smith, Director:

I herewith submit my report as botanist of the station for that portion of the year between my appointment in September, 1902, and the present date, June 30, 1903. During that period my time has been employed in the following manner: As I am also employed by the college as instructor in botany, only about one-half of my time has been devoted to the work of the station.

During the winter and spring terms of the college course considerable part of this time was spent in teaching the principles of plant life to special course students in the stock and fruit courses and the students in the beet sugar course. Laboratory methods were introduced whenever the size of the classes would permit and at other times the teaching consisted of lectures illustrated by means of experiments performed before the classes and by specimens. In the beet sugar course the students were instructed in the methods employed in testing seeds of sugar beets and others, each student performing the operations and keeping individual records.

Meetings of the State Horticultural Society were attended at Hart and at Lawton and at the latter place a paper on grape diseases was presented and illustrated with specially prepared stereopticon slides. A paper on fungus diseases of plants was also read at the Roundup Farmers' Institute at Owosso with stereopticon illustrations.

Most of the slides used were specially prepared and colored for the occasion.

Several inquiries were received during the winter in relation to diseases of greenhouse lettuce. Some of these fungous diseases are very destructive to certain varieties of lettuce, especially the head varieties, when grown in the greenhouse. This was very noticeable in the forcing houses at the college. One of the commonest of the fungi causing the rotting of lettuce is *Botrytis vulgaris* or Gray Mould. Another parasitic fungus on lettuce reported from Grand Rapids, was the Anthracnose or "leaf perforation" disease (*Marsonia perforans*). It has also been noticed that tomato plants grown after lettuce in the same soil are frequently attacked by the gray mould. Damping off of seedling melons has also been reported from one correspondent. A variety of other parasitic fungi have been sent in for identification and remedies.

The examination of clover, grass and other farm seeds for foreign matter and weed seeds and the testing for germination has taken considerable time. Numerous specimens of weeds with inquiries regarding their nature and the best means of combating them are being constantly received at the present time.

Another line of work in the nature of a specialty, has been the study of our native mushrooms and toadstools. Bulletin 208 relates to a few of the edible species in this group of fungi and is preliminary to other intended publications along this line. A large part of the illustrations and other matter in this bulletin had been accumulated for another purpose prior to my appointment as botanist of the station.

A paper has also been prepared giving directions for collection and study of fleshy fungi to become part of a circular for distribution among the high schools of the State. This circular is the outcome of the formation of a Nature Study Bureau organized in connection with the Michigan Academy of Science and the botanist of the station has consented to identify specimens of fungi which are sent in by teachers and others. This already forms quite an important part of the correspondence of the botanist. Another paper of the same nature has been prepared for presentation to the Detroit Mycological Club and numerous labeled specimens prepared to illustrate the subject.

Two interesting discoveries relating to parasitic fungus diseases of plants have been made this spring. One is the perithecial stage of the apple scab (*Venturia dendritica*). This stage has not been recognized here before and serves to familiarize the botanist with a somewhat recently discovered form of this common and serious disease.

The other fungus is the sclerotium-spore stage of the brown rot of plum, peach and cherry *sclerotinia fructigena*. This spore form was first discovered by Mr. J. B. S. Norton, botanist of the Maryland experiment station in 1902 and has thus been reported by him only.

Respectfully submitted,

B. O. LONGYEAR, Botanist.

Agricultural College, Mich.,
June 30, 1903.

METEOROLOGICAL TABLES.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Registering thermometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1	28.5	22.2	27	49	100	100	29.657	29.546	29.333	28	5
2	28.5	22.2	20	88	100	100	29.940	29.035	29.160	28	0
3	28.5	22.2	14	100	100	100	29.410	29.512	29.597	28	0
4	28.5	22.2	19	100	100	100	29.636	29.587	29.477	28	1
5	28.5	22.2	26	100	100	100	29.336	29.294	29.212	28	2
6	23	31	31	100	100	100	29.054	29.008	29.069	32	15
7	28	35	34	100	90	100	28.900	28.830	28.888	37	28
8	30	33	34	100	100	100	28.995	28.950	29.061	34	20
9	28	40	31	100	91	100	28.975	28.981	29.041	40	26
10	30	34	28	100	100	100	29.138	29.017	28.905	36	18
11	30	33	21	100	100	100	28.830	28.805	28.845	28	13
12	13	19	18	100	100	84	28.891	28.925	29.059	21	13
13	14	25	20	100	100	85	29.172	29.143	29.130	25	15
14	16	31	21	100	100	100	28.944	28.827	28.837	31	17
15	17	35	18	100	90	100	28.976	28.931	29.017	36	18
16	25	22	8	100	100	100	29.063	29.127	29.189	26	8
17	14	34	34	100	99	89	29.044	28.926	28.999	36	18
18	31	30	21	89	100	100	28.710	28.917	29.225	34	5
19	5	25	17	100	100	100	29.300	29.376	29.373	25	5
20	19	33	30	100	89	100	29.307	29.136	29.108	34	18
21	25	29	25	100	100	100	29.546	28.898	28.981	29	20
22	23	31	19	100	100	100	29.033	28.982	29.041	31	17
23	28	29	25	100	100	100	28.997	28.938	28.938	31	21
24	21	31	27	89	100	100	29.058	29.118	29.219	32	19
25	25	30	27	100	100	100	29.343	29.325	29.104	34	24
26	34	35	29	100	100	100	28.892	28.911	29.058	26	5
27	6	8	4	100	100	73	29.321	29.502	29.703	18	-8
28	6	7	4	100	100	73	29.892	29.831	29.403	9	-8
29	6	13	13	100	100	100	29.662	29.495	29.403	15	6
30	9	24	15	100	100	100	29.393	29.364	29.339	25	9
31	18	26	23	100	100	100	29.101	29.047	29.105	26	17
Sums										883	393
Means				97	98	97				28.45	12.66
Average				97							

JANUARY, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
0	.....	30	.....	50	.....	w	.....	s	.....	s	.....	8 p. m.	9 p. m.	.....	.....
50	.....	0	.....	50	.....	w	.....	n w	.....	s	.....	.....	.....	.....	.....
0	.....	.....	.....	.....	.....	n w	.....	n w	.....	s	.....	.....	.....	.....	.....
0	.....	100	Cu. St.	100	Cr. St.	n w	.....	s w	.....	s	.....	*	.....	.....	trace
100	Cu. St.	0	.....	30	Nim.	s	.....	.....	.....	.....	.....	.....	.....	.....	.....
100	Nim.	100	Nim.	.....	.....	s w	.....	s	.....	s w	.....	2 p. m.	.....	.....	trace
60	Cu. St.	70	Cu. St.	100	Nim.	s w	.....	s	.....	w	.....	.....	.....	.....	.....
100	.....	0	.....	0	.....	w	.....	s w	.....	e	.....	.....	.....	.....	.....
40	Cu. St.	0	.....	0	.....	s	.....	w	.....	s w	.....	.....	.....	.....	.....
70	Cu. St.	100	Cu. St.	100	.....	w	.....	w	.....	n w	.....	.....	.....	.....	.....
90	Cu. St.	100	Cu. St.	100	Nim.	n w	.....	w	.....	w	.....	7 p. m.	.....	.06	.6
100	Nim.	0	.....	50	Cu. St.	w	.....	n w	.....	n w	.....	.....	.....	.....	.....
0	.....	90	Cu. St.	100	Cu. St.	n w	.....	.....	.....	.....	.....	.....	.....	.....	.....
60	Cu. St.	0	.....	0	.....	s w	.....	s w	.....	s w	.....	.....	.....	.....	.....
0	.....	90	Cu. St.	100	Cu. St.	s w	.....	s w	.....	e	.....	6 p. m.	.....	.....	trace
100	Cu. St.	100	Cu. St.	0	.....	n e	.....	n e	.....	w	.....	.....	.....	.....	.....
0	.....	100	Cu. St.	0	.....	s w	.....	s w	.....	w	.....	.....	.....	.....	.....
90	Cu. St.	100	Nim.	0	.....	s	.....	.....	.....	.....	.....	2 p. m.	.....	.....	trace
0	.....	0	.....	0	.....	n w	.....	n w	.....	s e	.....	.....	.....	.....	.....
50	St.	90	Cu. St.	100	Nim.	s e	.....	s e	.....	s e	.....	.....	.....	.....	.....
100	Nim.	100	Nim.	100	Cu.	n e	.....	n e	.....	n	.....	.....	8 a. m.	.24	2.4
100	Cu.	0	.....	0	.....	n	.....	n	.....	w	.....	9 p. m.	.....	.02	.2
70	Cu.	100	Cu.	100	Nim.	s w	.....	s w	.....	s e	.....	.....	.....	.....	.....
50	Cu. St.	100	Cu.	100	Nim.	w	.....	n	.....	n	.....	.....	.....	.....	.....
100	Nim.	100	Cu.	100	Nim.	n w	.....	s	.....	s w	.....	.....	.....	.05	.5
100	Nim.	100	Nim.	100	Nim.	s	.....	s w	.....	n w	.....	.....	.....	.....	.....
25	St.	80	Nim.	0	.....	w	.....	w	.....	w	.....	.....	.....	.01	.1
20	St.	80	Cu. St.	.....	.....	w	.....	w	.....	n	.....	.....	.....	.....	.....
100	Cu.	90	Cu.	0	.....	n e	.....	n e	.....	n e	.....	.....	.....	.....	trace
80	Cu. St.	0	.....	70	Nim.	n e	.....	s e	.....	e	.....	.....	.....	.04	.4
100	Nim.	80	Cu.	80	Cu.	e	.....	s w	.....	s w	.....	8 a. m.	11 a. m.	.01	.1
60	.....	61	.....	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
60						.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*8.30 p. m.

† a. m., fog.

‡ In night.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	22	30	24	100	100	100	29.835	29.892	29.110	31	21
2.....	7	17	7	100	100	100	29.167	29.072	29.965	27	6
3.....	1	8	2	100	100	100	29.858	29.824	29.910	18	0
4.....	5	10	7	100	100	100	29.038	29.010	29.030	11	-7
5.....	10	11	20	100	80	85	29.015	29.962	29.899	22	-5
6.....	13	12	8	100	100	100	29.971	29.022	29.146	15	9
7.....	14	18	15	100	100	100	29.121	29.069	29.140	22	6
8.....	22	25	22	100	100	100	29.120	29.104	29.117	25	11
9.....	10	18	22	100	100	100	29.183	29.104	29.146	25	9
10.....	10	23	12	100	100	100	29.061	29.924	29.915	20	8
11.....	19	24	19	100	100	100	29.856	29.940	29.065	26	9
12.....	4	19	1	76	100	100	29.307	29.365	29.443	23	4
13.....	-6	21	10	100	86	100	29.512	29.453	29.411	23	-7
14.....	12	25	10	100	100	61	29.371	29.290	29.250	23	-6
15.....	20	28	24	100	100	100	29.128	29.974	29.914	26	7
16.....	12	26	16	100	100	100	29.820	29.737	29.715	29	9
17.....	12	22	12	100	100	100	29.836	29.808	29.068	27	5
18.....	-4	22	8	66	100	100	29.412	29.379	29.394	22	-8
19.....	-10	30	14	100	100	100	29.352	29.262	29.206	22	-12
20.....	4	36	22	100	90	86	29.118	29.036	29.048	32	-10
21.....	11	41	27	100	82	100	29.056	29.007	29.962	32	4
22.....	30	34	34	89	84	100	29.960	29.937	29.015	48	11
23.....	29	45	28	100	84	100	29.985	29.056	29.095	44	26
24.....	24	43	27	100	83	100	29.156	29.036	29.013	45	22
25.....	27	44	38	100	92	100	29.903	29.764	29.720	44	23
26.....	27	48	42	100	100	100	29.665	29.437	29.297	50	26
27.....	45	45	38	100	92	100	27.889	27.956	28.136	51	27
28.....										52	34
29.....											
Sums.....	360	725	496	26.31	26.73	27.32	783.656	782.470	783.170	817	228
Means.....				.97	.96	.96				29.18	7.96
Average.....											

FEBRUARY, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
40		60		100	Nim.										
100	Nim.	100	Nim.	100	Nim.	n		n		n		*	†	.2	.2
40	Cu.	100	Nim.	100	Nim.	w		n w		n w		Snow		.05	.5
40	Cu.	100	Nim.	50	Cu.	n w		w		w		Snow		.075	.75
0		30	St.	100	Nim.	w		s w		s w		Snow		.01	.1
100	Nim.	0		50	Cu.	s w		s w		s w		Snow		.02	.2
100	Nim.	100	Nim.	0	Nim.	s w		s w		s w		Snow		.03	.3
50	Cu. St.	0		60	Nim.	s w		w		w		Snow		.01	.1
60	Cu.	0		0		w		w		w					
0		0		0		s w		s w		s w					
0		80	Cu.	100	Nim.	s w		s w		s w		†	§	.01	.1
100	Nim.	90	Nim.	0	Nim.	n w		n		n		Snow		.01	.1
0		0		0		n		s w		s w					
0		0		0		n e		s		s					
90	Cu. St.					s e									
0		100	Cu. St.	100	Nim.			n w		n w		3 p. m.	6 p. m.		
0		80	Cir. Cu					n w		n w					
90		90		50		s w		n w		n w					
0		0		0		n		n w		w					
10		20		0		s w		s		n e					
0		0		0		n e		e		n e					
0		50	Cu. St.	0		n w		w		s w					
50	Cu. St.	30		50		s w		s w		s w					
100		0		40		w		n		n					
0		0		0		n e		n		n e					
0		20		0		s		s		s					
20		90		100		s e		s e		s e					
100		90		0		s e		s w		s w					
100						s									
10.99		12.30		10.00										.66	
.40		.46		.38											
.41															

* 7:30 a. m.

† In night.

‡ Snow in night.

§ 6:30 a. m.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	36	38	32	100	100	100	28.227	28.382	28.544	40	27
2.....	28	35	28	100	100	100	27.979	28.587	28.766	35	23
3.....	25	27	19	100	100	100	28.911	28.951	29.073	28	18
4.....	23	34	24	100	100	100	29.149	29.148	29.214	35	19
5.....	24	40	28	100	100	88	29.187	29.188	29.183	42	22
6.....	27	49	38	100	100	100	29.167	29.044	29.125	50	30
7.....	36	48	40	100	100	100	29.146	29.181	29.223	48	33
8.....	35	38	34	100	100	100	29.135	29.117	29.163	40	31
9.....	32	38	36	100	100	100	29.344	29.353	30.311	39	31
10.....	36	60	58	100	100	100	29.281	29.134	29.038	36	61
11.....	59	61	54	100	94	100	28.955	28.940	28.965	61	54
12.....	51	48	36	100	93	100	28.870	28.637	28.544	52	32
13.....	35	58	31	100	94	100	29.049	29.166	29.246	60	32
14.....	32	52	37	100	100	100	29.357	29.234	29.181	53	31
15.....	31	50	50	100	100	100	29.000	28.890	28.820	51	31
16.....	41	45	17	100	92	100	28.822	28.704	29.035	48	10
17.....	12	35	8	100	100	100	29.131	29.225	29.324	35	5
18.....	10	22	15	100	100	100	29.484	29.475	29.441	25	9
19.....	18	38	27	100	100	100	29.434	29.288	29.321	40	18
20.....	30	50	30	100	100	79	29.296	29.238	29.240	51	24
21.....	32	49	33	100	100	100	29.243	29.171	29.184	50	26
22.....	34	56	33	100	100	100	29.226	29.222	29.268	58	27
23.....	40	62	40	100	100	100	29.323	29.263	29.282	63	29
24.....	36	54	33	100	93	100	29.250	29.190	29.338	55	22
25.....	31	55	33	100	100	100	29.375	29.253	29.255	56	30
26.....	37	64	50	100	100	100	29.183	29.064	29.010	65	37
27.....	54	60	54	100	94	100	28.974	28.919	28.915	69	41
28.....	48	54	44	100	100	100	28.820	28.584	28.469	54	41
29.....	44	59	38	100	100	100	28.615	28.761	28.813	60	32
30.....	44	36	34	100	100	100	28.474	28.555	28.517	49	30
31.....	33	36	34	100	90	90	28.410	28.698	28.838	36	30
Sums.....	10.54	14.51	10.63	31.00	30.50	30.57	899.823	899.721	900.706	15.11	861
Means.....				100	96	99				48.74	27.45
Average.....					99						

MARCH, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds						Rain and snow.			
7 A. M.		3 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
100		100		100		s		s		s w		Snow			trace
100		70		80		s s		s s		s w		Snow			trace
90		0		0		n e		n e		n w					
0		10		0		n e		n e		n e					
50		0		0											
80		0		20		s s		s w		s w					
100		80		80		s s		s n o		s s					
100		100		100		s s		s w		s w		Mist			
100		100		80		s s		s w		s w					
0		80		100		s s		s		s					
100		100		100		s		s		s w					
100		90		100		s w		n w		s w		Rain		.73	
90		10		0		s w		s		s s				.76	
0		80		80		s w		s		s s					
50		100		80		s w		s		s		†	‡	.81	
10		10		50		s w		s w		w		§			¼
80		20		0		s w		w		w					
40		80		0		s w		w		w					
10		0		0		s w		n e		n e					
0		0		0		n e		n		n e					
80		50		0		n e		n		n e					
0		0		0		n e		n		n e					
0		40		20		n e		n e		n e					
0		0		0		n e		n e		n e					
0		60		50		e		e		e		|		.025	
20		0		10		e		e		e		6			
100		100		100		e		e		e			12 p. m.	.88	
0		0		0		e		e		e					
100		100		10		n w		w		n w		¶	2 p. m.	.81	8
100		100		100		n w		n		n w					
15.40		14.20		11.10										3.115	
50		46		36											
44															

* Rain in night. † Rain 10 p. m. ‡ 11:30 p. m. § Snow in night. | Rain slight. ¶ 6:30 a. m.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	32	36	31	100	100	100	28.839	28.913	28.933	35	30
2.....	32	36	31	100	100	100	28.914	28.915	29.053	38	35
3.....	31	47	36	100	100	90	29.126	29.132	29.159	49	26
4.....	35	49	36	100	93	90	29.171	29.113	29.072	51	26
5.....	37	56	55	81	69	93	29.065	28.941	28.840	56	34
6.....	42	48	44	91	100	92	28.705	28.748	28.885	51	26
7.....	26	27	25	88	100	100	29.024	29.085	29.143	34	24
8.....	27	50	44	100	68	84	29.118	29.068	29.006	52	26
9.....	41	56	35	82	76	90	28.993	28.899	28.968	61	29
10.....	41	64	43	82	68	83	28.993	28.922	28.945	64	38
11.....	45	54	42	84	80	83	28.948	28.850	28.823	57	36
12.....	37	42	33	100	83	100	28.721	28.880	29.048	44	31
13.....	34	36	34	100	90	100	29.176	29.173	29.231	42	33
14.....	37	46	33	90	69	100	29.344	29.334	29.314	48	32
15.....	39	53	34	31	80	100	29.349	29.178	29.238	54	31
16.....	38	56	42	91	75	100	29.043	29.027	29.015	58	36
17.....	45	60	39	84	77	100	28.980	28.907	28.968	62	32
18.....	43	65	49	67	73	100	28.965	28.887	28.942	66	42
19.....	51	57	44	86	87	100	28.890	28.910	29.045	61	27
20.....	42	64	51	91	78	86	29.130	29.042	29.048	66	42
21.....	63	70	67	83	80	89	28.828	28.747	28.727	66	62
22.....	68	82	55	79	71	93	28.805	28.666	28.788	82	41
23.....	42	42	32.5	91	91	89	28.893	29.143	29.274	46	28
24.....	41	57	46	82	87	76	29.334	29.313	29.304	58	29
25.....	56	47	47	94	92	92	29.182	28.886	28.798	58	44
26.....	48	47	42	93	92	91	28.306	28.397	28.668	48	34
27.....	48	61	43	93	82	92	29.122	29.122	29.193	62	34
28.....	51	68	50	79	74	100	29.214	29.088	29.112	68	43
29.....	51	50	48	93	94	93	28.993	28.907	29.000	61	43
30.....	48	58	44	93	88	92	29.176	29.258	29.326	61	30
Sums.....							870.302	869.395	870.895	16.62	10.12
Means.....				88	84	93				55.40	33.75
Average.....				88							

APRIL, 1902. AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
100				100		NW				NW					
100		100		0		NW		NW		NW					
0		0		0		NW		NW		NW					
0		0		0		NE				NE					
20		20		100		S		SW		SW					
100		100		100		S		S		S		*		.08	
100		100		100		NW		NW		NW		snow		.2	
100		30		0		NW		NW		NW					
0		5		0		NW		NW		NW					
0		0		0		W		SW		SW		*		trace	
0															
0		60		0		SW				W				.08	
100		100		30		SW				W					
100		100		100		SW				W					
30		30		10		NE		NE		NE					
0		0				NE		NE		NE					
100		50		90		SW		SW		W					
40		40		0		SW		SW		SW					
40		40		20		SW		SW		SW					
40		40		70		W		NW		W					
80		50		0		S		S		S		*		.04	
30		100		30		S		S		S					
20		10		100		SW		SW		SW		*		.10	
100		80		0		SW		SW		SW					
0		0		60		W		NW		W					
100		100		90		W		SE		SE		†		1.12	
100															
100		100		30		S		SW		W		*		.16	
0		0		0		W		W		W					
0		20		10		W		SE		S					
100		90		10		SE		W		W					
80		0		20		W		NW		NW					
15.80		18.65		10.70											
53		47		37											
46															

* Rain in night.

† Rain night and day.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	41	62	51	91	77	93	29.394	29.253	29.236	63	39
2.....	52	78	56	93	73	94	29.004	28.866	28.927	78	44
3.....	54	74	55	93	81	87	29.120	29.026	29.075	75	51
4.....	51	75	61	88	90	100	29.946	28.944	29.042	78	51
5.....	53	66	58	93	79	81	29.198	29.325	29.226	69	49
6.....	54	69	59	100	90	88	29.095	28.817	28.843	76	46
7.....	49	62	48	86	67	93	29.050	29.006	29.194	64	43
8.....	60	75	55	77	56	74	29.110	28.909	29.151	75	32
9.....	39	49	42	82	85	84	29.312	29.335	29.376	53	33
10.....	34	38	37	79	91	90	29.437	29.285	29.316	44	30
11.....	44	57	44	68	75	84	28.337	29.281	29.270	58	34
12.....	53	69	58	79	75	94	29.242	29.124	29.134	70	50
13.....	52	70	47	100	77	92	29.125	29.165	29.310	61	32
14.....	52	60	44	79	77	84	29.377	29.159	29.242	61	31
15.....	54	63	50	80	83	93	29.280	29.224	29.200	65	40
16.....	55	68	.....	87	84	.....	.....	.....	.....	70	53
17.....	65	76	58	84	77	94	29.075	29.944	29.003	76	53
18.....	45	77	65	84	95	100	29.001	28.770	28.853	77	60
19.....	75	87	67	48	84	100	28.892	29.144	28.167	87	58
20.....	74	80	66	90	87	95	29.165	29.093	29.290	81	56
21.....	66	78	67	89	86	84	29.271	29.218	29.135	85	59
22.....	60	81	66	71	87	100	29.037	28.946	29.002	77	61
23.....	73	74	67	76	81	100	29.972	29.913	28.877	77	57
24.....	65	74	65	91	86	100	28.942	28.914	28.922	74	60
25.....	65	73	58	94	85	100	28.918	28.961	29.028	74	52
26.....	38	61	42	88	.....	83	28.968	29.185	29.063	63	36
27.....	41	60	42	82	55	91	29.071	29.039	29.130	54	30
28.....	46	61	45	84	45	100	29.194	29.938	29.128	60	32
29.....	58	76	63	76	82	91	29.214	29.098	29.063	72	56
30.....	66	78	60	84	82	100	29.154	29.138	29.254	79	50
31.....	69	78	65	85	65	91	29.327	29.270	29.273	78	62
Suma.....	1687	.....	.....	26.13	23.57	27.66	874.509	872.121	873.656	3178	1439
Means.....	.....	.....	.....	84	79	92	.....	.....	.....	70.26	46.42
Average.....	.....	.....	.....	85			.....	.....	.....	.....	.....

MAY, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
Per cent. of cloud.	Kind.	Per cent. of cloud.	Kind.	Per cent. of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
0	0	.....	70	.....	n e	.....	n e	.....	e	.....	*	7 a. m.	.07	.....
80	0	.....	10	.....	s s w	.....	n w	.....	n w	.....	*	9 a. m.	.09	.....
40	50	.....	100	.....	s s e	.....	s w	.....	n w	.....	*	.....	.54	.....
20	30	.....	100	.....	s s e	.....	n	.....	n e	.....	*	.....	.08	.....
80	10	.....	10	.....	n e	.....	n	.....	n e	.....	*	.....	.....	.....
100	50	.....	50	.....	s e	.....	s	.....	s w	.....	*	.....	.65	.....
100	50	.....	0	.....	s w	.....	n w	.....	n	.....	*	.....	.80	.....
25	5	.....	0	.....	s w	.....	s w	.....	n	.....	*	.....	.....	.....
40	Cu.	30	Cu.	0	.....	s w	.....	n w	.....	n	.....	*	.....	.....	.....
100	100	.....	80	.....	s w	.....	n e	.....	n e	.....	*	.....	.35	2
0	0	.....	0	.....	n e	.....	n	.....	n	.....	*	.....	.....	.....
0	0	.....	100	.....	n w	.....	s e	.....	n	.....	*	.....	.....	.37
100	95	.....	0	.....	n e	.....	n e	.....	n e	.....	*	.....	.....	.....
0	10	.....	0	.....	n e	.....	n e	.....	n e	.....	*	.....	.....	.....
0	0	.....	0	.....	n e	.....	n e	.....	n e	.....	*	.....	.....	.....
90	5	.....	0	.....	s e	.....	s	.....	s	.....	*	.....	.....	.....
5	0	.....	10	.....	s w	.....	s w	.....	s w	.....	*	.....	.....	.....
90	100	.....	60	.....	s	.....	s	.....	s	.....	*	.....	.93	.....
75	50	.....	10	.....	s	.....	s	.....	s w	.....	*	.....	.....	.....
30	25	.....	50	.....	n e	.....	n e	.....	s e	.....	*	.....	.....	.....
0	10	.....	0	.....	s e	.....	s e	.....	e	.....	*	1 p. m.	.13	.....
30	25	.....	0	.....	s w	.....	s w	.....	w	.....	*	2 p. m.	.12	.....
60	Cir.St.	70	Cir.St.	0	.....	s w	.....	s w	.....	s w	.....	*	.....	.14	.....
50	Cu.	.....	.....	80	.....	s w	.....	w	.....	w	.....	*	5 p. m.	.06	.....
70	Cir.St.	80	Cu.	0	.....	n w	.....	n w	.....	w	.....	*	.....	.....	.....
0	80	.....	n w	.....	n	.....	n	.....	*	.....	.....	.....
100	50	Cu.	0	.....	n w	.....	n w	.....	n	.....	*	.....	.....	.....
0	20	Cu.	0	.....	n w	.....	n w	.....	n	.....	*	.....	.....	.....
0	5	Cu.	0	.....	s w	.....	s w	.....	s	.....	*	.....	.....	.....
0	25	Cu.	0	.....	s w	.....	n w	.....	n	.....	*	.....	.....	.....
90	80	.....	0	.....	s w	.....	s w	.....	s w	.....	*	.....	.60	.....
137.5	92.5	.....	81.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.71	.....
44	33	.....	26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
34						.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*In night.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	73	83	65	90	67	100	29.261	29.101	29.088	83	62
2.....	69	86	65	95	68	100	29.181	29.081	29.097	86	63
3.....	65	75	63	100	81	89	29.982	29.942	29.047	75	50
4.....	66	77	64	89	57	94	29.095	29.109	29.251	73	47
5.....	60	71	56	82	71	94	29.296	29.241	29.218	71	49
6.....	67	77	63	89	82	100	29.987	29.982	29.788	77	62
7.....	69	76	65	90	77	100	29.762	29.992	29.930	76	49
8.....	60	67	52	77	84	100	29.118	29.092	29.145	67	40
9.....	60	67	60	82	.....	100	29.115	29.045	29.785	72	58
10.....	64	68	58	89	100	94	29.863	29.917	29.983	72	52
11.....	52	79	68	93	87	95	29.823	29.813	29.882	81	52
12.....	61	82	68	94	83	95	29.978	29.828	29.837	82	59
13.....	65	74	64	100	90	94	29.922	29.962	29.052	76	61
14.....	65	80	68	95	96	100	29.032	29.902	29.847	81	61
15.....	71	88	.....	100	88	.....	29.875	29.776	29.827	89	57
16.....	62	72	54	88	56	74	29.872	29.011	29.057	73	45
17.....	64	77	53	78	82	73	29.060	29.086	29.092	78	52
18.....	70	84	55	80	57	93	29.048	29.941	29.982	84	52
19.....	66	75	57	94	52	100	29.025	29.033	29.037	75	54
20.....	60	67	52	88	74	100	29.045	29.942	29.961	67	49
21.....	55	60	46	87	77	84	29.991	29.052	29.058	60	41
22.....	54	65	46	74	63	92	29.118	29.098	30.113	64	39
23.....	55	66	46	81	69	84	29.163	29.138	29.118	66	46
24.....	61	77	55	82	57	87	29.058	29.992	29.923	73	50
25.....	57	60	46	94	100	84	29.715	29.480	29.532	63	39
26.....	56	66	48	81	59	70	29.742	29.806	29.865	66	40
27.....	64	71	55	89	71	87	29.979	29.927	29.978	66	48
28.....	59	.....	55	88	.....	100	29.961	29.975	29.848	65	51
29.....	55	68	54	100	90	100	29.766	29.924	29.908	57	53
30.....	57	57	50	100	100	86	29.738	29.768	29.963	64	43
Sums.....	.....	.....	.....	2,659	2,140	2,669	869.627	868.856	869.217	2,182	1,524
Means.....	.....	.....	.....	89	76	92	.....	.....	.....	72.73	50.80
Average.....	.....	.....	.....	.....	86	.....	.....	.....	.....	.....	.....

JUNE, 1903, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain or snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
90		40		100		s w		e		s e		4 p. m.		.45	
100		50		100		n		s w		w		5 p. m.		.3	
100		100		0		s w		s		s		7 a. m.		.13	
0		10		0		s w		n w		n w					
0		10		0		n e		s e		s		12 m.		.99	
0		100		100		s e		s e		s w					
20		75		50		s w		w		n w				.09	
30	Cu.	25	Cu.	0		n w		n w							
30		50		70		s w		s w		s w					
50		90		90		s w		w		n e					
90		20		0		n e		s		s w					
70		20		50		n e		s e		s		3 p. m.	7 a. m.	1.23	
100		80		10		s w		n e		s e		7 a. m.	9 a. m.	.7	
80		20		90		s		s		s w					
40		50		0		s w		s w		w		*		.82	
90		40		0		w		n w		n					
0		10		0		n e		s w		s w					
5		10		100		s		s		s e		*		.10	
0		0		100		s e		s w		s w					
100		100		100		s e		s e		s		4 p. m.		.50	
90		80		0		n w		n w		n w					
0		50		0		s e		s e		s w		10 a. m.		trace	
0		50		0		s w		s w		s w				trace	
0		0		0		s w		s w		s w					
100		100		100		s e		s		n w		7 a. m.	6 p. m.	.37	
0		40		0		n w		n w		n w					
25		70		0		n w		n w		w					
100		100		100		n e				n w		4 p. m.		.94	
100		0		100		n w		n		n e		5 p. m.		.60	
100		100		0		n e		n e						.06	
														7.28	
50		49		41											

47

* In night.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Registering thermometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	63	77	60	94	61	48	29.075	29.097	29.123	75	43
2.....	60	75	71	100	90	100	29.111	29.972	28.860	75	59
3.....	73	84	70	45	71	93	28.880	28.929	28.912	56	59
4.....	73	90	74	77	63	91	28.980	29.896	28.962	90	66
5.....	82	90	73	88	80	95	28.912	28.903	28.932	90	68
6.....	79	87	75	87	92	95	28.947	28.968	29.008	89	70
7.....	75	87	73	95	96	95	29.028	28.997	29.092	87	68
8.....	79	89	73	91	51	95	29.077	29.041	29.017	89	67
9.....	70	79	68	100	95	100	29.964	28.924	29.032	79	50
10.....	64	73	58	84	50	91	29.161	29.152	29.161	75	48
11.....	68	77	63	79	69	89	29.171	29.112	29.072	77	52
12.....	70	86	62	80	76	94	29.042	29.047	28.992	86	57
13.....	63	87	61	91	72	94	29.075	28.947	29.000	87	57
14.....	81	71	69	83	95	100	28.962	29.120	29.897	86	61
15.....	72	81	62	85	55	89	28.875	28.974	28.965	79	54
16.....	62	82	70	91	60	90	28.990	28.902	28.837	81	61
17.....	79	87	72	82	58	95	28.777	28.776	28.867	87	61
18.....	68	89	64	91	100	95	28.940	28.972	28.940	69	63
19.....	66	74	64	100	95	100	28.832	28.870	28.942	75	60
20.....	65	73	61	100	95	91	28.810	28.750	28.780	75	56
21.....	58	78	59	100	100	91	28.823	28.880	28.920	73	50
22.....	70	75	63	80	93	100	28.990	28.990	29.038	80	57
23.....	64	81	65	89	87	95	29.030	29.027	29.080	80	56
24.....	70	83	66	90	96	93	29.042	29.009	29.040	83	60
25.....	76	83	66	81	96	100	28.990	28.965	28.950	85	63
26.....	74	88	67	86	100	100	28.930	28.912	28.935	88	63
27.....	76	81	64	91	93	100	28.932	28.912	28.927	80	62
28.....	67	77	69	91	71	100	28.957	28.922	28.947	79	57
29.....	67	84	72	89	83	90	28.947	28.917	28.945	84	58
30.....	67	.....	73	45	.....	95	28.993	29.044	29.070	96	62
31.....	74	78	69	81	100	100	29.002	28.990	29.015	85	62
Sums.....	2112	2417	2007	2775	2156	2957	898.203	897.646	898.202	2540	1836
Means.....				90	82	95				81.94	59.19
Average.....					89						

JULY, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
20	50	0	n e	n e	e	7 a. m.	Night	1.60
100	40	.....	100	.....	n e	.....	n e	.....	s w	.....			
80	80	.....	50	.....	n w	.....	n w	.....	s w	.....			
10	10	.....	0	.....	n e	.....	s e	.....	s w	.....			
10	5	.....	0	.....	w	.....	s w	.....	n w	.....			
10	30	0	w	s w	s	+	+	trace
100	100	.....	0	.....	n w	.....	n w	.....	s w	.....			
5	5	.....	100	.....	s w	.....	n w	.....	s w	.....			
100	50	.....	80	.....	n w	.....	n w	.....	w	.....			
0	50	.....	0	.....	n	.....	n	.....	n w	.....			
0	75	0	s w	n w	w	12	2 p. m.	.97
0	0	.....	0	.....	w	.....	w	.....	s w	.....			
0	0	.....	0	.....	w	.....	w	.....	s w	.....			
0	90	.....	20	.....	w	.....	s e	.....	s w	.....			
20	10	.....	0	.....	s w	.....	s w	.....	s w	.....			
100	60	20	e	s	w	Night	+	.33
90	10	.....	30	.....	w	.....	n w	.....	w	.....			
100	100	.....	100	.....	s e	.....	s e	.....	s	.....			
100	100	.....	100	.....	s w	.....	w	.....	w	.....			
90	100	.....	90	.....	n w	.....	n w	.....	n	.....			
100	50	100	n	n w	n w	2 p. m.	6 p. m.	.65
0	90	.....	10	.....	.....	.....	w	.....	w	.....			
0	75	.....	0	.....	n w	.....	n w	.....	n w	.....			
0	80	.....	20	.....	s w	.....	s w	.....	w	.....			
0	100	.....	30	.....	s w	.....	s w	.....	s w	.....			
0	50	20	s w	s w	s w	10	Night	trace
40	90	.....	80	.....	w	.....	n w	.....	n w	.....			
10	80	.....	50	.....	s w	.....	n w	.....	n e	.....			
50	80	.....	10	.....	s w	.....	n w	.....	n	.....			
0	0	.....	0	.....	s w	.....	s w	.....	w	.....			
0	100	60	s w	s w	s w	12		.53	
12.25	17.60	10.70	7.13
40	57	35
44					

* Thunder. † In night.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1	67	82	65	100	100	100	29.022	29.006	29.036	82	56
2	73	82	65	76	87	100	29.967	28.894	28.900	84	52
3	75	82	65	90	87	89	28.872	28.911	28.977	82	53
4	64	77	63	83	69	89	28.990	28.961	28.866	77	56
5	70	81	62	80	87	100	28.787	28.764	28.870	81	53
6	80	70	58	94	75	94	28.880	28.892	28.895	70	45
7	56	72	56	87	100	100	28.800	28.787	28.735	72	52
8	64	73	55	89	76	100	28.823	28.881	28.960	73	45
9	65	78	65	84	89	100	28.845	28.839	28.812	72	56
10	67	78	64	89	91	100	28.845	28.839	28.812	81	56
11	61	65	51	94	78	93	28.940	29.022	29.110	70	41
12	52	69	56	93	90	94	29.209	29.163	29.158	71	48
13	57	70	59	87	90	94	29.135	29.080	29.080	70	56
14	63	71	59	89	90	94	29.093	29.065	29.060	76	56
15	59	71	57	100	90	100	29.053	28.968	29.000	71	50
16	55	70	51	87	95	86	29.055	29.020	29.018	72	46
17	58	75	57	84	90	100	29.013	28.922	28.880	76	50
18	60	78	59	86	78	100	28.825	28.744	28.708	83	56
19	62	71	58	100	90	100	28.875	28.832	28.962	72	56
20	62	76	63	100	91	94	28.918	28.880	28.912	79	57
21	61	71	57	94	86	75	28.955	28.990	29.075	74	44
22	52	69	55	93	95	87	29.105	29.052	29.068	69	42
23	50	72	50	100	90	100	29.148	29.067	29.135	72	46
24	56	77	50	87	91	93	29.201	29.128	29.166	76	48
25	55	77	53	87	86	100	29.186	29.117	29.080	80	48
26	55	79	60	87	70	88	29.058	28.989	29.035	80	52
27	58	80	64	94	78	100	29.053	29.026	29.132	80	49
28	56	80	62	94	82	100	29.123	29.112	29.173	81	49
29	57	81	63	87	83	94	29.201	29.150	29.186	82	51
30	59	87	69	94	76	96	29.120	29.027	28.975	87	57
31	73	80	64	85	91	89	28.890	28.839	28.880	82	56
Sums.....	1743	2187	1703	2800	2495	2948	870.162	866.248	866.822	2379	1601
Means.....				90	86	95				76.74	51.66
Average.....					90					25.00	

AUGUST, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
90		50		0		nw		ne		ne					
0		75		0		sw		sw		zw					
0		10		0		sw		sw		nw					
0		0		20		n		n		n					
100		50		0		sw		w		nw					
90		50		0		ne		n		n					
100		100		100		se		sw		nw				.18	
10		20		0		w		nw		nw					
0				100		se		se		sw					
20		40		80		w		w		nw			7 a. m.	.10	
0		90		0		nw		w		w				.11	
0		30		40		w		se		w					
100		100		80		sw		s		s					
70		40		0		sw		n		n					
100		100		80		nw		nw		n					
0		0		0		n		n		se					
70		20		0		sw		sw		sw					
10		50		30		se		s		sw					
100		80		60		n		n		sw					
100		90		30		s		s		sw				.07	
0		20		20		w		sw		w				.10	
0		10		0		nw		n		n					
30		10		0				n		n					
0		0		0		s		sw		sw					
0		40		10		s		s		sw					
0		10		0		sw		w		w					
0		10		20		nw		n		n					
0		0		0				n		n					
10		0		0		ne		n		nw					
0		30		80		s		s		sw					
100		90				sw		s		c			11	.12	
11.00		12.15		7.50											.78
.35		.41		.25											
.34															

* 8:30 a. m.

+ 11:30 a. m.

‡ 4:30 p. m.

§ Rain in night.

Rain, 2 p. m.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Registering thermometer.	
	7 A. M.	9 P. M.	9 P. M.	7 A. M.	9 P. M.	9 P. M.	7 A. M.	9 P. M.	9 P. M.	Maximum.	Minimum.
1.....	64	80	59	89	62	100	28.915	28.889	28.972	80	46
2.....	55	76	59	87	64	78	29.063	29.046	29.032	77	47
3.....	80	72	55	82	100	100	28.903	28.862	28.831	72	46
4.....	58	67	44	93	64	100	28.981	29.061	29.166	67	35
5.....	46	71	55	92	71	87	29.227	29.124	29.098	71	49
6.....	57	73	55	87	76	100	28.953	28.925	29.005	77	48
7.....	61	77	53	77	69	86	29.028	29.004	29.008	77	48
8.....	63	82	52	83	67	93	28.958	28.696	28.688	82	49
9.....	49	60	52	100	77	100	28.671	28.727	28.721	65	39
10.....	47	70	57	85	90	87	28.973	28.894	28.895	71	49
11.....	58	64	50	94	78	100	28.953	29.028	29.098	64	47
12.....	50	49	47	100	100	100	29.106	29.075	29.078	53	40
13.....	48	57	45	92	100	108	29.118	29.110	29.194	57	32
14.....	44	69	47	84	85	100	29.240	29.119	29.123	69	38
15.....	47	69	49	85	86	100	29.121	29.092	29.095	69	43
16.....	52	73	52	86	50	100	29.169	29.092	29.125	73	49
17.....	54	81	59	87	52	94	29.121	29.022	29.003	81	52
18.....	60	60	52	94	100	100	29.003	29.003	29.108	60	49
19.....	51	55	51	100	100	100	29.145	29.112	29.118	55	49
20.....	55	72	57	100	80	94	29.180	29.067	29.042	75	50
21.....	66	75	61	89	82	94	29.020	29.012	29.005	79	56
22.....	65	85	65	89	64	94	28.998	28.937	28.922	81	60
23.....	65	65	54	94	100	100	28.912	28.898	28.905	71	51
24.....	55	53	50	100	100	100	29.022	28.982	28.958	44	55
25.....	49	57	54	100	100	100	28.892	28.857	28.772	62	48
26.....	61	68	56	100	95	94	28.864	28.857	28.843	72	52
27.....	59	70	58	100	80	100	28.755	28.604	28.574	71	54
28.....	62	65	60	100	100	100	28.747	28.832	28.898	69	57
29.....	61	76	60	100	77	77	28.940	28.967	28.892	57	75
30.....	60	61	48	100	100	100	28.712	28.647	28.848	64	41
Sums.....	.....	.....	.....	2,769	2,468	2,876	869.700	868.531	869.093	2,066	1,425
Means.....	.....	.....	.....	92	82	96	.....	.....	.....	69.87	47.50
Average.....	.....	.....	.....	90			.....	.....	.....	.....	22.37

115

[illegible]

1 Killing frost.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	45	58	52	92	64	73	28.958	28.982	29.092	61	47
2.....	46	63	50	85	72	86	29.092	29.062	29.128	63	46
3.....	50	58	48	93	70	85	29.188	29.251	29.105	59	45
4.....	49	54	52	78	65	73	28.990	28.842	28.990	59	48
5.....	52	52	45	86	100	100	28.710	28.702	28.705	54	39
6.....	45	65	52	100	58	79	28.720	28.798	28.855	68	39
7.....	44	62	.....	84	51	.....	28.897	28.908	29.028	62	35
8.....	47	69	60	85	56	71	28.932	28.940	29.092	71	41
9.....	43	52	38	75	60	81	29.281	29.272	29.296	54	27
10.....	33	67	52	79	89	86	29.271	29.084	28.992	67	38
11.....	52	71	56	93	71	100	28.877	28.767	28.778	69	47
12.....	52	65	53	100	100	100	28.750	28.692	28.640	61	51
13.....	57	52	40	87	86	100	28.582	28.619	28.892	54	33
14.....	35	45	37	100	76	71	29.023	28.980	28.896	46	32
15.....	44	60	37	76	71	100	28.888	28.872	28.900	60	34
16.....	40	48	38	73	63	72	29.168	29.128	29.184	49	30
17.....	35	57	45	80	69	91	29.186	29.120	29.092	57	43
18.....	50	63	.....	100	83	.....	28.930	28.917	28.932	67	48
19.....	58	65	38	82	84	72	28.922	28.872	29.096	65	30
20.....	44	57	38	84	52	72	29.191	29.148	29.304	58	25
21.....	38	54	41	81	55	82	29.381	29.278	29.146	55	36
22.....	49	47	50	71	100	100	28.997	28.902	29.042	65	46
23.....	51	65	56	93	78	87	29.062	28.974	28.967	65	50
24.....	62	73	50	88	85	79	28.822	28.682	29.105	73	42
25.....	45	53	50	84	78	100	29.211	29.160	28.892	73	44
26.....	63	73	53	83	100	78	28.785	28.780	28.905	73	46
27.....	50	53	44	93	83	84	28.913	28.875	28.842	53	30
28.....	48	46	33	100	84	100	28.845	28.840	29.086	46	24
29.....	48	52	35	88	73	90	29.206	29.170	29.105	52	33
30.....	50	60	30	86	55	100	29.047	29.108	29.204	58	28
31.....	29	63	44	100	83	76	29.401	29.378	29.356	63	36
Sums.....	1340	1692	1316	2699	2319	2484	99.116	898.161	899.537	1880	1196
Means.....	.....	.....	.....	87	75	86	.....	.....	.....	60.65	38.54
Average.....	.....	.....	.....	83	.....	.....	.....	.....	.....	.....	22.07

OCTOBER, 1902, AT AGRICULTURAL COLLEGE, LANSING, MICH.

Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
90	10	.....	0	.....	n	.....	n	.....	n	.....	.....	.....	.....	.....
50	90	.....	20	.....	nw	.....	nw	.....	nw	.....	.....	.....	.....	.....
20	50	.....	100	.....	ne	.....	ne	.....	ne	.....	.....	.....	.....	.....
60	100	.....	100	.....	ne	.....	se	.....	nw	.....	.....	.....	.....	.....
100	100	.....	100	.....	ne	.....	ne	.....	ne	.....	9 a. m.	Night	.69	.....
10	0	.....	80	.....	se	.....	se	.....	sw	.....	.....	.....	.....	.....
0	20	.....	0	.....	n	.....	nw	.....	ne	.....	.....	.....	.....	.....
0	5	.....	30	.....	sw	.....	sw	.....	nw	.....	.....	.....	.....	.....
100	0	.....	0	.....	n	.....	ne	.....	ne	.....	.....	.....	.....	.....
0	0	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	0	.....	0	.....	s	.....	sw	.....	ne	.....	.....	.....	.....	.....
100	100	.....	100	.....	e	.....	ne	.....	se	.....	All day	.....	.37	.....
100	100	.....	100	.....	sw	.....	sw	.....	sw	.....	Snow	.....	.01	.....
100	100	.....	75	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	50	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	95	.....	0	.....	ne	.....	ne	.....	ne	.....	.....	.....	.....	.....
0	0	.....	90	.....	ne	.....	se	.....	se	.....	.....	.....	trace	.....
100	50	.....	80	.....	sw	.....	w	.....	nw	.....	.....	.....	.....	.....
20	10	.....	10	.....	nw	.....	ne	.....	se	.....	.....	.....	.....	.....
10	10	.....	0	.....	sw	.....	nw	.....	n	.....	.....	.....	.....	.....
0	0	.....	0	.....	se	.....	se	.....	se	.....	.....	.....	.....	.....
100	100	.....	100	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	50	.....	100	.....	ne	.....	se	.....	sw	.....	.....	.....	.....	.....
40	0	.....	0	.....	sw	.....	sw	.....	nw	.....	.....	.....	.....	.....
100	100	.....	100	.....	se	.....	se	.....	se	.....	*	.....	.32	.....
100	100	.....	100	.....	se	.....	se	.....	sw	.....	12	3 p. m.	.14	.....
100	100	.....	100	.....	sw	.....	w	.....	nw	.....	.....	.....	.....	.....
100	80	.....	60	.....	nw	.....	nw	.....	nw	.....	.....	.....	.....	.....
20	10	.....	50	.....	nw	.....	nw	.....	nw	.....	.....	.....	.....	.....
0	0	.....	0	.....	nw	.....	nw	.....	nw	.....	.....	.....	.....	.....
0	0	.....	0	.....	w	.....	nw	.....	ne	.....	.....	.....	.....	.....
1820	1430	.....	1495	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.53	.....
59	46	.....	48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
51						.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* In night.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	44	68	48	76	84	86	29.233	29.164	29.154	68	46
2.....	56	89	61	63	96	94	29.090	29.090	29.167	96	42
3.....	45	58	50	92	53	86	29.161	29.114	29.118	58	40
4.....	47	53	50	100	80	100	29.032	29.017	29.005	53	47
5.....	51	54	47	100	100	100	28.942	28.722	28.806	54	44
6.....	45	50	32	92	66	100	28.958	29.042	29.180	50	25
7.....	28	47	32	100	77	100	29.221	29.152	29.235	47	20
8.....	34	56	40	79	100	73	29.132	29.114	29.138	56	36
9.....	48			70							
10.....										52	33
11.....	34	63	55	100	100	93	29.155	28.965	28.905	63	36
12.....	58	69	62	70	90	97	28.862	28.892	28.942	69	53
13.....	57	66	55	81	95	100	28.978	28.950	29.002	66	50
14.....	53	68	45	100	96	84	28.906	28.837	28.752	68	41
15.....	43	45	44	93	84	92	29.011	29.030	29.106	45	41
16.....	43	45	42	92	100	100	29.163	29.114	29.148	45	39
17.....	40	47	44	100	92	84	29.092	29.030	28.998	47	40
18.....	44	48	35	92	93	70	28.942	28.960	29.055	48	31
19.....	37	53	38	90	80	91	29.092	29.092	29.104	53	33
20.....	35	60	45	90	71	84	29.131	29.065	29.042	60	41
21.....	49	54	44	93	80	92	28.990	28.934	28.942	54	39
22.....	44	56	45	92	88	84	28.782	28.767	28.905	56	28
23.....	35	48	42	70	85	83	28.918	28.890	28.748	48	38
24.....	45	47	32	92	85	100	28.594	28.617	28.705	47	24
25.....	25	39	29	100	82	100	28.841	28.792	28.705	39	25
26.....	31	34	30	89	100	100	28.604	28.557	28.620	34	25
27.....	26	29	20	100	100	100	28.685	28.802	28.931	29	13
28.....	14	35	25	100	90	100	29.177	29.129	29.005	35	17
29.....	30	37	30	100	100	100	28.848	28.792	28.592	37	23
30.....	25	38	26	100	91	100	29.140	28.965	28.942	38	23
Sums.....				2615	2455	2572	811.719	810.625	811.25	1492	1001
Means.....				90	88	92				51.45	34.52
Averages.....				90							16.98

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Clouds.						Winds.						Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.		Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.				
25	50	.....	50	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
0	0	.....	100	.....	sw	.....	sw	.....	sw	.....	.....	.....	.10	.....
100	0	.....	100	.....	nw	.....	sw	.....	sw	.....	.....	.....	trace	.....
100	10	.....	100	.....	sw	.....	sw	.....	nw	.....	7 a. m.	11 p. m.	.05	.....
100	100	.....	100	.....	sc	.....	sc	.....	sc	.....	.....	.....	1.05	.....
100	100	.....	100	.....	nw	.....	nw	.....	sw	.....	.....	.....	.....	.....
0	0	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
0	0	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
80	sw	.....	sw	.....	.....	.....	.....	.....	.....	.....
100	100	.....	100	.....	sw	.....	sw	.....	.....	.....	.....	.....	.08	.....
100	100	.....	90	.....	sc	.....	sc	.....	sc	.....	12 m.	night	.03	.....
100	100	.....	100	.....	sw	.....	sw	.....	sw	.....	.....	.....	trace	.....
100	20	.....	100	.....	sw	.....	sw	.....	sw	.....	.....	.....	.15	.....
0	100	.....	100	.....	sc	.....	sc	.....	sw	.....	.....	.....	.07	.....
100	100	.....	100	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	100	.....	100	.....	w	.....	w	.....	w	.....	3 p. m.	night	.40	.....
100	100	.....	100	.....	ne	.....	ne	.....	ne	.....	.....	.....	.....	.....
100	100	.....	100	.....	ne	.....	ne	.....	sc	.....	.....	.....	.....	.....
0	0	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
0	0	.....	90	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	0	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.08	.....
100	90	.....	0	.....	sw	.....	w	.....	ne	.....	.....	.....	.....	.....
20	100	.....	100	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
100	20	.....	0	.....	w	.....	w	.....	nw	.....	.....	.....	.....	.....
0	0	.....	0	.....	ne	.....	ne	.....	ne	.....	.....	.....	.....	.....
100	100	.....	100	.....	ne	.....	ne	.....	ne	.....	11 p. m.	night	.....	3
100	60	.....	50	.....	sw	.....	nw	.....	nw	.....	.....	.....	.....	.....
0	20	.....	80	.....	sw	.....	nw	.....	ne	.....	11 night	.....	.....	2
100	100	.....	0	.....	sc	.....	sw	.....	sw	.....	12 m.	.....	trace	trace
0	0	.....	0	.....	sw	.....	sw	.....	sw	.....	.....	.....	.....	.....
.....	2.00	5.00
65	54	.....	64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

† Snow.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.			Relative humidity or per cent of saturation.			Barometer reduced to freezing point.			Register- ing ther- mometer.	
	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Maximum.	Minimum.
1.....	28	45	30	100	84	100	28.900	28.757	28.752	45	28
2.....	28	39	33	100	100	100	28.745	28.557	28.507	39	29
3.....	28	35	28	100	100	100	28.479	28.760	28.898	35	23
4.....	24	27	25	100	100	100	29.035	28.930	28.902	27	23
5.....	25	28	25	100	100	100	28.908	28.975	29.038	28	23
6.....	28	35	28	100	100	100	29.073	29.048	29.065	23	35
7.....	25	29	18	100	100	100	29.078	29.055	29.050	29	11
8.....	12	19	15	100	100	100	29.296	29.276	29.287	19	10
9.....	11	31	20	100	100	100	29.267	29.188	29.031	31	11
10.....	31	34	29	100	100	100	28.866	28.935	28.955	34	22
11.....	23	27	20	100	100	100	29.018	28.902	29.098	27	12
12.....	15	26	21	100	100	100	29.182	29.188	29.105	26	16
13.....	18	27	15	100	100	100	29.039	29.171	29.287	27	4
14.....	10	29	21	100	100	100	29.506	29.388	29.230	29	16
15.....	28	38	33	100	100	100	29.138	28.822	28.823	38	28
16.....	28	31	30	100	100	100	28.779	28.795	28.881	31	23
17.....	28	32	26	100	100	100	28.918	28.810	28.905	32	24
18.....	25	39	30	100	82	100	28.973	28.948	28.922	39	26
19.....	31	39	30	100	82	100	28.905	28.942	28.985	39	39
20.....	35	42	38	100	100	100	28.995	28.898	28.818	42	42
21.....	40	45	38	100	100	100	28.650	28.602	28.805	45	34
22.....	35	36	32	100	90	100	29.000	29.188	29.284	36	24
23.....	25	29	27	100	100	100	29.339	29.233	28.908	30	25
24.....	29	22	20	100	100	100	28.806	28.692	28.620	34	10
25.....	20	22	19	100	100	100	28.898	28.890	29.006	22	10
26.....	11	12	8	100	100	110	29.121	29.098	29.098	14	-3
27.....	11	22	20	100	100	100	29.106	29.026	29.058	23	11
28.....	19	23	19	100	100	100	29.083	29.021	28.916	24	15
29.....	23	30	21	100	100	100	28.773	28.813	28.878	31	17
30.....	18	22	19	100	100	100	29.061	29.151	29.200	22	7
31.....	10	31	20	100	100	100	29.195	29.110	29.138	32	10
Sums.....	724	945	756	3100	3088	3100	899.125	898.349	898.405	965	572
Means.....				100	98	100				31.13	18.45
Average.....				99							12.68

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[illegible]

* Snow in night. † 1 p. m., snow. ‡ Snow, 2 p. m. § 11 a. m., rain. ¶ 4 a. m., snow. * In night.

BULLETINS
OF THE
AGRICULTURAL COLLEGE EXPERIMENT STATION
ISSUED DURING THE
YEAR ENDING JUNE 30, 1903

EXPERIMENT STATION BULLETINS.

ANALYSES OF SOME OF THE COMMERCIAL FEEDING STUFFS OF MICHIGAN.

FLOYD W. ROBISON, B. S., CHEMIST.

Bulletin No. 303.

The feeding stuffs of which the analyses are reported in this bulletin were purchased in the open market in various parts of the State by farmers and feeders and samples sent to the station for analysis.

No attempt has been made to make a careful canvass of the State nor to secure samples of all feeding stuffs offered in Michigan markets.

The thanks of the station are due to the persons who have so far interested themselves in the matter as to send samples of the feeds purchased.

Definition of Terms.

There are several technical terms that must be used in the discussion of the composition of feeding stuffs. These terms were defined at some length in bulletin 149 (Report for 1898, page 250), now out of print. A brief definition of these terms therefore follows:

1. *Water*.—All feeds contain more or less water depending on their nature and on the treatment they have undergone. The so-called dry feeds, like hay or cornmeal, will contain from five to fifteen per cent. of water, while corn silage has in every hundred pounds fully eighty pounds of water and a hundred pounds of such roots as turnips may contain ninety pounds of water. Beet pulp, as it leaves the factory, usually has about 93 per cent. of water. It is this water that gives the succulent character to roots, silage, beet pulp and like materials. Just to what degree this succulent character is an advantage has not been fully determined.

2. *Protein*.—The protein or nitrogenous part of the feeding stuff is the part of it which corresponds to the lean meat, the white of eggs, or cheese, in the human dietary. Its distinguishing characteristic is that it is the only part of the material which contains nitrogen. It is, in the North, at least, the most expensive constituent of the feeding stuff and the one in which the grasses and grains of the farm are most lacking.

It is the protein of the food that is used by the system to replace waste muscle and tissue, to supply the casein of milk, and is essential to carry forward the activity of the vital organs.

Experiments almost without number have demonstrated that dairy cows need large quantities of protein in their daily ration, the amounts varying from one and one-half to three pounds, depending on the amount of milk secreted and the size of the cow. Fattening steers, lambs and swine need a less amount per thousand pounds live weight, but even with fattening animals there is need of much more protein than is usually found present in the hay, cornstalks and corn, constituting the ordinary ration for such animals on the Michigan farms. *The commercial feeding stuffs are purchased to supply this lack of protein.*

3.—The word *Fat* in the tables below is used in its ordinary sense, meaning the fatty or oily substance in the food, for all feeding stuffs, commercial or home-grown contain fat resembling in chemical composition, if not in physical appearance, such common fats as lard, butter, olive oil or cottonseed oil. The principal use of the fat seems to be to supply heat and energy.

4. *Nitrogen-free Extract*.—By nitrogen-free extract chemists mean the starch, sugar and similar constituents of the food. All cereals and cereal products contain a high percentage of starch and sugar. The hay, straw, cornstalks, corn and oats are made up quite largely of starch and are therefore said to be rich in *nitrogen-free extract*.

5. *Crude Fiber*.—The stems and leaves of forage plants consist quite largely of woody fibers to give them strength and stiffness. The stomachs and intestines of ruminants are adapted to the digestion and utilization of part at least of this woody material, which chemists call *Crude Fiber*. Naturally the coarser feeds, the straw and stalks, stems and husks, and even the leaves and outer coverings of the grains contain high percentages of crude fiber. This crude fiber is not without value as a nutrient. Digestion experiments have shown that both ruminants and horses are able to utilize part of the crude fiber of their food. Of the crude fiber of straw, domestic animals are able to digest and utilize from 36 to 61 per cent.; of the crude fiber of hay from 40 to 72 per cent. and of the crude fiber of the grains from 20 to 80 per cent.

Farther experiments have seemed to show that this digested crude fiber is equivalent in all respects to starch and in the computation of rations the digested crude fiber and the digested nitrogen-free extract are reckoned together and are called *carbohydrates*.

6. *Ash*.—This is the mineral matter in the feed and consequently what would be left behind if the feed were burned. Every crop grown on the farm contains some ash and animals are nearly always sure to get all of this material that their system demands from their regular rations.

7. *Dry Matter*.—This term is frequently used in analytical tables and in calculating a ration. It refers to the amount of solid matter in a food after the moisture has been excluded. It represents the sum of all the constituents of a food *except water*. No food as found on the market is wholly dry matter. They all contain some water.

It is evident then that the ingredient the feeder needs to buy, and what is most valuable and usually deficient, is *protein*. The next point of consideration is: In what food is the protein most economical?

If bran, for example, containing 12 per cent. of digestible protein, sells at \$18.00 per ton, it is manifestly not economy to pay \$20.00 per ton for a feed containing but 8 per cent. of digestible protein. This lack of relation between price and protein content is a very common one. It is very plain that a comparison of feeds should be made from the standpoint of their composition, for a feed low in protein is not worth as much as a feed high in protein. A flattering advertisement does not raise the percentage of protein. It should then be kept constantly in mind that *primarily* a feeding stuff is bought to supply an ingredient in which the farmers produce is deficient, namely *protein*.

What Not to Buy.

Do not buy what can be raised on your own farm. The farmer will not or should not therefore buy corn for he can usually grow it more cheaply than he can buy it, and it does not contain sufficient protein to balance a ration. He will, for the above reasons, buy no feed containing as low a content of protein as does corn. Hay, silage, corn fodder, corn stover, straw, etc., all are home-grown products and are ample to supply *crude fiber* and furnish bulk to the ration. Therefore the feeder cannot afford to buy these materials.

The points to be considered then in buying a commercial feeding stuff are, first, a high *protein* content, and second, a low *crude fiber* content.

The first shows the presence in considerable amount of the very desirable muscle-forming principle. The second shows the absence, in any marked degree, of oat hulls, corn cobs, and roughages in general.

In table 1 following are given the analyses of the feeding stuffs examined. The *Nitrogen-free Extract* and *ash* were not determined in these samples.

Notes on Table 1.

Oat Feeds.—There are on the market various ground feeds, some of them labeled "Oat Feeds," some "Corn and Oat Feeds," and others simply called "Ground Feeds." In nearly all of them some of the oat by-products play an important rôle. Oat hulls, as the analysis shows, have a low feeding value and they are very frequently used in the above-named feeds instead of oats. If the *crude fiber* is above 12 per cent. in such feeds it is usually safe to assume that oat hulls have been added in excess of what would be present in ground oats. Some of these feeds contain corn offal and an admixture of gluten feed, etc., to raise the percentage of protein. "Victor C. & O. Feed," with its 13.4 per cent. of *crude fiber*, and "Royal Oat Feed," with 25.4 per cent. of *crude fiber*, would come in this class. Twenty-five and four-tenths per cent. of *crude fiber* in the "Royal Oat Feed" shows that it is little better than oat hulls alone.

Oil Meals.—Oil cake meal and oil meal are synonymous terms and refer to the linseed meal after the oil has been removed. After crushing the flaxseed, it is heated and placed between cloths and the oil pressed out by great pressure. The residual cake is sold as a stock food. This old process oil meal still contains from 6 to 10 per cent. of linseed oil. The new process oil meal differs from the old process in that the oil is extracted by the use of a solvent, usually naphtha. This new process oil meal contains much less oil than does the old process. The pressed cake from the old process is sometimes put on the market in cake form, but in this country it is usually ground and sold as oil meal, sometimes however as nut or pea size when not finely ground.

Cottonseed Meal.—This well-known product is not often adulterated. After the cottonseed envelopes have been removed the kernels containing the oil are crushed, heated and subjected to pressure, as in the case of old process oil meal. The residual yellow cotton oil cake is ground and appears on the market in the form of meal.

Gluten Feed and Gluten Meal.—In the manufacture of starch and glucose the soaked corn is coarsely ground and the starch and germ liberated. The germ or sprout of the corn grain is floated off and dried,

TABLE I.

Name of feed.	Manufacturer.	Sampled at.	Price per ton.	Per cent water.	Per cent protein.	Per cent Fat.	Per cent crude fiber.
111 Victor C. and O. Feed.....	The American Cereal Co.	Adrian.....	\$21.00	9.05	8.49	3.30	13.40
112 Oil Cake Meal.....	Wright & Hill.....	Traverse City.....	32.00	8.22	36.13	7.30	8.44
113 Oil Meal (old process).....	Toledo Linseed Oil Co.	Adrian.....	32.00	8.63	33.96	6.33	8.63
114 Cotton Seed Meal.....	The American Cotton Oil Co.	Edwardsburg.....	28.00	7.58	43.70	9.48	8.40
115 Cotton Seed Meal.....	The American Cotton Oil Co.	Zeeland.....	*28.00	8.10	42.35	9.40	3.68
116 Cotton Seed Meal.....	N. K. Fairbanks & Co.	Traverse City.....	32.00	8.80	46.07	8.30	4.98
117 Cotton Seed Meal.....	The American Cotton Oil Co.	Adrian.....	28.00	8.03	40.96	11.84	6.28
118 Oats Middlings.....	Jacob Beck & Son.	Ann Arbor.....	20.00	7.35	17.11	8.05	3.93
119 Oil Meal (old process).....	O'Brien Varnish Co.	Edwardsburg.....	30.00	8.80	39.05	6.44	7.25
120 Oil Meal (old process).....	Wright & Hill.....	Edwardsburg.....	30.00	9.20	35.10	4.73	6.85
121 Starch Refuse.....	Michigan Starch Co.	Coopersville.....	27.50	9.06	23.78	8.93	8.48
122 Gluten Feed.....	Michigan Starch Co.	Traverse City.....	25.01	9.70	25.01	8.73	7.00
123 Gluten Feed.....	Michigan Starch Co.	Grand Rapids.....	27.00	7.55	26.83	9.03	5.98
124 Gluten Feed.....	Glucose Sugar Refining Co.	Armada.....	19.40	7.10	27.47	2.60	7.30
125 Gluten Feed.....	Glucose Sugar Refining Co.	Edwardsburg.....	21.00	8.65	23.57	2.33	7.42
126 No. 1 Corn and Oats.....	J. H. Ebeling, Green Bay, Wis.	Ingalls.....	32.00	11.50	10.79	3.06	3.60
127 No. 1 Ground Feed.....	J. B. Daugman Mill Co.	Gladstone.....	30.00	12.10	10.86	3.66	4.95
128 Tryabita.....	Tryabita Food Co.	Augusta.....	16.00	7.55	10.36	1.70	1.80
129 Bran.....	Glucose Sugar Refining Co.	Kalamazoo.....	(a) 14.00	9.25	18.07	4.35	11.35
130 Buffalo Gluten Feed.....	Glucose Sugar Refining Co.	Kalamazoo.....	24.00	8.13	26.59	2.85	7.35
131 Starch Feed.....	Jackson Starch Works	Grass Lake.....	22.00	11.05	3.34	0.50	1.15
132 Gluten Meal.....	Glucose Sugar Refining Co.	Grass Lake.....	28.00	7.28	34.49	2.40	3.00
133 Corn and Oats.....	Diamond Milling Co.	Ontonagon.....	33.00	11.00	10.79	4.65	3.40
134 Sugar Beet Pulp (dried).....	Alma Beet Sugar Factory	Alma.....	(d) 12.00	7.10	8.51	0.40	20.20
135 O. O. Corn and Oat Feed.....	Diamond Elevator and Milling Co.	Munising.....	12.35	12.35	10.97	4.20	5.60
136 Atlas Gluten Meal.....	Atlas Feed and Milling Co.	Dimondale.....	(b) 20.75	4.73	35.53	14.08	13.83
137 Clark's Dairy Food.....	H. W. Rickel & Co.	Adrian.....	28.00	6.30	30.71	10.95	19.48
138 Malt Sprouts.....	Great Western Cereal Co.	Detroit.....	12.00	5.93	29.39	1.15	11.45
139 Royal Oat Feed.....	Great Western Cereal Co.	Detroit.....	17.50	7.45	4.82	2.75	25.40
140 Buffalo Feed.....	Lanhoff Bros.	Detroit.....	21.00	8.58	10.71	3.96	7.05
141 Oats.....				11.00	11.80	5.00	9.50
142 Oat Hulls.....				7.34	3.30	1.00	29.70
143 Corn (Dent).....				10.60	10.30	5.00	2.20
144 Corn Cob.....				10.70	2.40	0.50	30.10

* F. O. B., Chicago.

(a) F. O. B., Chicago.

(b) F. O. B., Kalamazoo.

(c) Henry's Feed and Feeding

(d) F. O. B., Alma.

ground and sold as germ meal after the corn oil has been removed by pressure. The starch, which is in suspension in the water, forming a milky fluid, is now allowed to stand in large reservoirs, whence it, along with some of the gluten, settles to the bottom. This gluten is removed dried and sold as gluten meal. It is exceedingly rich in protein. The remaining by-products of the corn are dried, ground and sold as gluten feed. This separation into gluten meal is not always made, but all of the residue, after the removal of the starch, is sold sometimes as gluten feed. Lab. No. 151, "Starch Refuse," comes under the head of gluten feed.

The sample labeled *Tryabita*, Lab. No. 158, is a product from a breakfast cereal mill. In composition it corresponds closely to the breakfast food which goes by that name and possibly represents a rejected batch.

Starch Feed, Lab. No. 161, is not a gluten feed, but is almost pure starch. It contains some particles of gluten and looks much like a product known as rice polish, obtained in the manufacture of starch from rice. Its feeding value from a protein standpoint is very low.

Sugar Beet Pulp is a product on which the farmers of Michigan are quite well informed. Several of the beet sugar factories are now drying the beet pulp and it is finding its way into the market in increasing quantities.

Atlas Gluten Meal is guaranteed to contain 35 per cent. of protein and 14 per cent. of fat. The analysis sustains the guaranty. It contains more crude fiber than is found in any of the grains, but its protein content is sufficiently high to make it a desirable feed from this standpoint. The fiber is supplied mainly by the grain hulls and corn bran present.

Clark's Dairy Food in appearance resembles *Atlas Gluten Meal*. It contains more hulls and more bran which gives it a higher content of crude fiber. It also contains less protein.

Malt Sprouts. In the manufacture of beer from barley the grain is allowed to sprout, during which process the barley starch is converted into malt sugar. When the tiny sprouts have reached a certain length the barley is dried and the sprouts shaken off by sieving. In the malt-houses these sprouts accumulate in very large quantities. They are economical sources of protein, but because of their peculiar taste stock do not at first relish them, but soon become fond of them. They can be fed profitably in small quantities, and the manure from animals fed on Malt Sprouts is very valuable because of the high per cent. of ash.

Sample No. 170, Buffalo Feed, is not as its name might signify, a gluten feed. It contains about the same quantity of protein as corn, but about three times as much crude fiber. Its appearance would indicate it to be a by-product of the nature of flaked hominy.

Table II below shows the feeds arranged in the order of protein content. The one containing the highest percentage of protein being placed first, etc.:

TABLE II.

ARRANGED IN THE ORDER OF PROTEIN CONTENT.

Lab. No.	Name of feed.	Manufacturer.	Protein, per cent.	Price per ton.
148	Cotton Seed Meal.....	N. K. Fairbanks & Co.....	46.07	†\$32 00
144	Cotton Seed Meal.....	The American Cotton Oil Co.....	43.70	26 00
145	Cotton Seed Meal.....	The American Cotton Oil Co.....	42.55	28 00
147	Cotton Seed Meal.....	The American Cotton Oil Co.....	40.98	28 60
149	Oil Meal (old process).....	Obrien Varnish Co., South Bend.....	39.05	30 00
142	Oil Cake Meal.....	Wright & Hill, Chicago.....	36.15	32 00
166	Atlas Gluten Meal.....	Atlas Feed & Milling Co., Peoria.....	35.53	20 75
150	Oil Meal (old process).....	Wright & Hill, Chicago.....	35.10	30 00
162	Gluten Meal.....	Glucose Sugar Refining Co., Chicago.....	34.49	26 00
143	Oil Meal (old process).....	Toledo Linseed Oil Co., Toledo.....	33.96	28 60
167	Clark's Dairy Food.....		30.71	28 00
168	Malt Sprouts.....	H. W. Rickel & Co., Malters, Detroit.....	29.39	12 00
154	Gluten Feed.....	Glucose Sugar Refining Co., Chicago.....	27.47	19 00
160	Buffalo Gluten Feed.....	Glucose Sugar Refining Co., Chicago.....	26.59	24 00
153	Gluten Feed.....	Michigan Starch Co., Traverse City.....	26.33	27 00
152	Gluten Feed.....	Michigan Starch Co., Traverse City.....	25.01	25 00
155	Gluten Meal*.....	Glucose Sugar Refining Co., Chicago.....	23.7	21 00
151	Starch Refuse.....	Michigan Starch Co., Traverse City.....	23.78	27 50
159	Bran.....	Chicago.....	18.07	†14 00
145	Oats Middlings.....	Jacob Beck & Sons, Detroit.....	17.11	20 00
165	O. O. Corn and Oat Feed.....	Diamond Elevator & Milling Co.....	10.97	---
156	No. 1 Corn and Oats.....	John H. Ebeling, Green Bay, Wis.....	10.79	32 00
163	Corn and Oats.....	Diamond Milling Co., Minn.....	10.79	33 00
170	Buffalo Feed.....	Lanhoff Bros., Flaking Roller Mills, Detroit.....	10.1	21 00
158	Tryabita.....	Tryabita Food Co., Battle Creek.....	10.36	16 00
157	No. 1 Ground Feed.....	J. B. Dausman Mill Co.....	10.36	30 00
164	Sugar Beet Pulp (dried).....	Alma Beet Sugar Factory.....	8.51	12 00
141	Victor C. & O. Feed.....	The American Cereal Co., Chicago.....	8.49	21 00
169	Royal Oat Feed.....	The Great Western Cereal Co., Chicago.....	4.82	17 50
161	Starch Feed.....	Jackson Starch Works, Jackson.....	3.34	22 00

* This is a gluten feed and not gluten meal.

† F. O. B. Chicago.

Table III shows the Feeds arranged with reference to *Crude Fiber* content. The one lowest in *Crude Fiber* being placed first, etc.

TABLE III.

ARRANGED WITH REFERENCE TO CRUDE FIBER.

Lab. No.	Name of feed.	Manufacturer.	Crude fiber, per cent.	Price per ton.
161	Starch Feed.....	Jackson Starch Works.....	1.15	\$22 00
138	Tryabita.....	Tryabita Food Co.....	1.80	16 00
162	Gluten Meal.....	Glucose Sugar Ref. Co.....	3.00	28 00
163	Corn and oats.....	Diamond Milling Co.....	3.40	33 00
156	No. 1 Corn and oats.....	John H. Ebeling.....	3.80	32 00
148	Oats Middlings.....	Jacob Beck & Sons.....	3.93	20 00
152	Gluten Feed.....	Michigan Starch Co.....	3.98	25 00
157	No. 1 Ground Feed.....	J. B. Dausman Mill Co.....	4.95	30 00
146	Cottonseed Meal.....	N. K. Fairbanks & Co.....	4.98	32 00
165	O. O. Corn and Oat Feed.....	Diamond Elevator and Milling Co.....	5.80	.....
145	Cotton Seed Meal.....	The American Cotton Oil Co.....	5.63	*28 00
153	Gluten Feed.....	Michigan Starch Co.....	5.98	27 00
147	Cottonseed Meal.....	The American Cotton Oil Co.....	6.23	28 00
150	Oil meal (old process).....	Wright & Hill.....	6.85	30 00
170	Buffalo Feed.....	Lanhoff Bros.....	7.05	21 00
149	Oil Meal (old process).....	Obrien Varnish Co.....	7.25	30 00
154	Gluten Feed.....	Glucose Sugar Ref. Co.....	7.20	19 00
160	Buffalo Gluten Feed.....	Glucose Sugar Ref. Co.....	7.35	24 00
155	Gluten Feed.....	Glucose Sugar Ref. Co.....	7.42	21 00
143	Oil Meal (old process).....	Toledo Linseed Oil Co.....	8.38	28 00
144	Cottonseed Meal.....	The American Cotton Oil Co.....	8.40	26 00
143	Oil Cake Meal.....	Wright & Hill, Chicago.....	8.45	32 00
151	Starch Refuse.....	Michigan Starch Co.....	8.48	27 50
159	Bran.....	.....	11.35	*14 00
168	Malt Sprouts.....	H. W. Rickel & Co.....	11.45	12 00
141	Victor C and O Feed.....	The American Cereal Co.....	13.20	21 00
166	Atlas Gluten Meal.....	Atlas Feed and Milling Co.....	13.33	20 75
167	Clarks Dairy Food.....	.....	19.48	28 00
164	Sugar Beet Pulp (dried).....	Alma Beet Sugar Factory.....	20.20	12 00
169	Royal Oat Feed.....	The Great Western Cereal Co.....	25 40	17 50

* F. O. B. Chicago

It will be noticed by a reference to the above table that a low percentage of crude fiber is not a proof of a high protein percentage. It is, however, a proof of the absence in large quantities of oat hulls, corn-cobs, etc. The point here is not that a feeding stuff should be rejected simply because it contains a considerable amount of crude fiber, but it should be rejected unless it contains sufficient protein to balance the high percentage of crude fiber. The feeder cannot afford to *pay for* crude fiber when he has an abundance of it on his own farm.

Below is given a table (Table IV) showing the approximate amount of digestible protein in each of the feeding stuffs examined. While absolute reliance should not be placed on the percentages in this table, they may be taken as representing *quite closely* the actual digestibility of each feed. The data regarding the digestive coefficients are compiled from various sources; some from Jordan's tables and Henry's Feeds and Feeding, and some computed by the writer.

TABLE IV.

Lab. No.	Name of feed.	Approximate digestive coefficient of protein. Per cent.	Approximate per cent of digestible protein.
141	Victor C. and O. Feed	71	6.08
142	Oil Cake Meal	89	32.17
143	Oil Meal (O. P.)	89	30.22
144	Cotton Seed Meal	88	38.46
145	Cotton Seed Meal	88	37.44
146	Cotton Seed Meal	88	40.34
147	Cotton Seed Meal	88	36.06
148	Oats Middlings	81	14.37
149	Oil Meal (O. P.)	89	34.75
150	Oil Meal (O. P.)	89	31.24
151	Starch Refuse	86	20.45
152	Gluten Feed	86	21.51
153	Gluten Feed	86	22.64
154	Gluten Feed	86	23.62
155	Gluten Feed	86	20.53
156	No. 1 Corn and Oats	77	8.31
157	No. 1 Ground Feed	77	7.98
158	Tryabita	84	8.70
159	Brn	79	14.28
160	Buffalo Gluten Feed	86	22.87
161	Starch Feed		
162	Gluten Meal	89	30.70
163	Corn and Oat	77	8.31
164	Sugar Beet Pulp (dried)		
165	O. O. Corn and Oat Feed	77	8.45
166	Atlas Gluten Meal	73	25.94
167	Clark's Dairy Food	73	32.42
168	Malt Sprouts	80	23.51
169	Royal Oats Feed		
170	Buffalo Feed	77	8.25
	Oats	78	9.20
	Oat hulls	89	1.29
	Corn (Deut)	76	7.83
	Corn Cob	17	0.41

TABLE V.

Approximate cost of protein in the various grades of feeding stuffs reported in this bulletin.

100 pounds protein costs in—	Amount.
Bran at \$18 00 per ton, about.....	\$5 62
Linseed Meals, (oil meals).....	4 18
Cotton Seed Meals.....	8 80
Gluten Meal.....	8 75
Gluten feeds.....	4 71
Atlas Gluten Meal.....	2 93
Clark's Dairy Food.....	4 56
Low grade Oat Feeds.....	14 47

The calculations made in Table V represent the averages of the different feeds coming under the heads designated and are based on the prices quoted in Table I. A comparison of them from a commercial standpoint is here very easily made and the lack of relation between price and real value from a protein standpoint is very evident. Compared on this basis the Low Grade Oat Feeds are nearly three times as expensive as Bran, and over four times as costly as Cottonseed Meal. They may sell for less money but when their feeding values are calculated they will be found to be exceedingly costly sources of protein.

MOSQUITOES AND OTHER INSECTS OF THE YEAR 1902.

R. H. PETTIT, B. S., ENTOMOLOGIST.

Bulletin No. 204.

The present bulletin is a short, popular resume or abstract of Special Bulletin Number 17. The larger bulletin is more technical in its nature, and contains much of little interest to the general reader. It will, however, gladly be sent to anybody who desires it.

The entomologist is, at all times, glad to answer any questions within his knowledge, relating to insects, their work, or their control. It is always best to enclose a part of the insect or of its work. In the case of scale-insects, it is best to send a good-sized sample, as it usually is necessary to have a full-grown female in good condition for a correct determination. Send as many insects as practicable in any case. Send them in a tight tin box if convenient, and always feel free to send and to ask questions. In this way we are often able to render timely aid and to find out what pests are causing the most trouble, and which consequently may demand the most attention and the strongest efforts.

MOSQUITOES.

The interest which recently has been awakened in relation to the subject of mosquitoes and their relation to the spread of disease, has induced the writer to carry on an experiment bearing on the control of these insects. The objects of this experiment were to test oil and fish as mosquito destroyers; to find out as much as possible about the kinds or species with which we have to deal; to find where they breed in the vicinity of the College, and to gain some idea as to the range necessary to be treated in order to protect a given locality in our State.

We are indebted to Dr. L. O. Howard for starting and maintaining experiments some years ago in relation to this matter, and for awakening popular interest in relation to mosquito control and consequent immunity from several diseases. It is now a generally accepted belief that malaria, or fever-and-ague, is due to a germ, or more strictly speaking, to a low form of animal life which lives in the corpuscles of the blood in man and which is introduced there by certain mosquitoes of the genus *Anopheles*; the mosquitoes in turn obtaining the germs with the blood of their victims, of course providing they bite some one suffering from the disease. In other words then, the mosquito serves as a carrier of ague germs from a diseased person to one in health. Furthermore, the germs are said to undergo certain changes in the body of the mosquito, which changes may indicate the necessity of the mosquito, to a prolonged life in the case of the germ. Further, it is believed that yellow fever is spread by another mosquito which, fortunately, is not found as far north as Michigan.

The fact that mosquitoes are nuisances in every sense of the word, would seem to offer sufficient reason for exciting our interest, but the fact that they actually are a menace to health makes the question one of prime importance.

The life-history of the common *Culex*, a genus of non-malarial mosquitoes, is as follows: The eggs are laid in raft-like masses, on the sur-

face of the water, being stuck together, side by side, in large numbers, sometimes more than three hundred in a mass. (The eggs of the malarial mosquitoes of the genus *Anopheles* are said to be laid separately on the water without being joined in a raft-like body.) These eggs hatch usually in one or two days each, by an opening or lid on the underside, giving forth a small wiggler. The wigglers are so well known that a description seems superfluous; slender little creatures, each with a swollen thorax and a head at the lower end, and with a breathing-tube at the upper end. Usually the larva rests at the surface of the water, its breathing-tube projecting above the surface film, leaving the head free to feed upon microscopic plants and animals. After a time, varying from a week to several months, the larva changes to a pupa. The

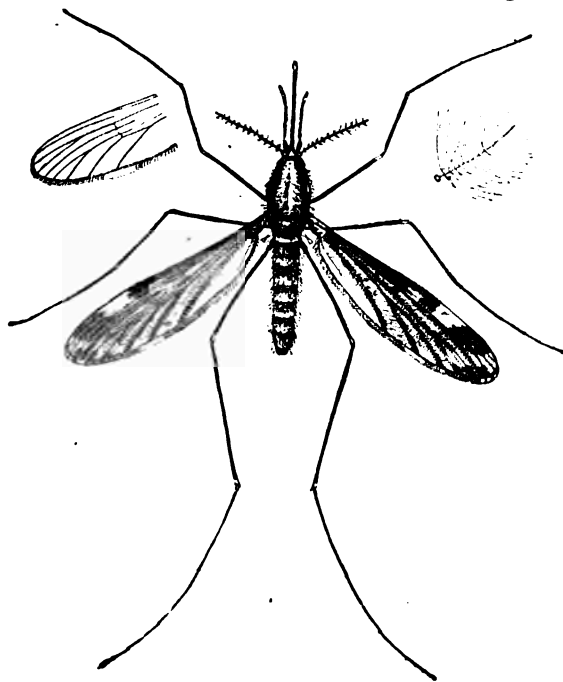


Fig. 1.—Malaria mosquito, from Howard, Bulletin 25, n. s., U. S. Department of Agriculture.

skin of the larva splits and the robust, swollen pupa emerges. In this stage the insect breathes by means of two trumpet-shaped tubes which project from the shoulders. After about two days more the pupal skin splits down the back, and spreading open, serves as a support on which the adult insect stands while drying its wings and legs. After this is accomplished, the adult flies away to mate, to lay the eggs for a succeeding brood, and if fortunate enough, to taste human blood. We have in Michigan a number of different kinds of mosquitoes. The commoner sorts belong to the two genera, *Culex* and *Anopheles*. The members of the former genus are by far the more numerous in summer time, and are the ones usually seen in the open, and during the day time. They are not known to carry the germs of any disease, but are classed simply as nuisances. *Anopheles*, on the other hand, seems to prefer such localities as are sheltered by trees, houses, etc., and while it will bite during the day time, it is more apt to choose the night time

for its excursions. It is the members of the genus *Anopheles* that carry malaria. Of course the insect will not produce the disease, it can only carry it from individual to individual when once present.

The practical methods of fighting mosquitoes may be classed under three heads, viz.: Draining; introducing fish, which are known to feed on the wigglers, into fishless ponds; and spreading oil upon the surface of their breeding places. Of these three, the first is of course the most permanent and effective. It can not be otherwise than perfect since it destroys the breeding places and therefore the mosquitoes. The second method—introducing fish into the breeding places—seems more of a palliative measure than one which will result in extermination. The third method—spreading oil on the breeding places—is the most expensive of the three, although it is almost as certain as the first. The oil forms a thin film on the surface of the water and coming in contact with the breathing tubes, kills the wigglers, as it kills almost all insect life. The field work in the present experiments was done almost entirely by Mr. Bronson Barlow, and it was owing to his efficient work and careful notes and observations that the work was rendered possible.

An area of four square miles was at first laid out as a basis on which to work. A map was made on which was indicated so far as possible all the breeding places of the pests, and records of each treatment were carefully set down.

On April 21st, such ponds as would not be injured by oil were treated with a coat of petroleum oil, known as light fuel oil. This spread over the surface and in a few hours killed all the mosquitoes, both in the larval and in the pupal stages. The oil is that recommended by Dr. Howard. It cost about \$4.50 per barrel here at the College and was applied at the rate of one-half gallon to one thousand square feet of water space, or one ounce to fifteen square feet. This amounts to about half a barrel to an acre. It was applied by means of a knap-sack spray-pump fitted with a plain nozzle, that is a nozzle having a hole 3-32 of an inch in diameter. With this it was possible to throw the oil twenty feet or more in a solid stream and thus to reach far in toward the center of a pond. Actual counts showed the number of wigglers to be as large as 900 to a square foot at this time, in small areas.

Many surprises await the person who tries to exterminate mosquitoes. Hollows, made by the breaking off of limbs, were found to furnish fine homes for mosquito families. Rain-barrels, sometimes furnish unheard-of numbers. Pools in the woods, drains, open cisterns, and cisterns not tightly screened, watering troughs, in fact almost anything that will hold water and which is not exposed to too much wind, will keep them. The ideal places in this vicinity were found to be swales with cottonwoods or willows standing in them. Another likely place was found in poorly-drained woodland. Woodland ponds were likely to be pretty well stocked with the malarial mosquitoes. Ponds covered with green water-scum often harbored the malarial species, and in such places fish work at a great disadvantage, the larvae being very successful in hiding away.

FISH.

Dr. Howard highly recommends the introduction of small sun-fish and stickle-backs in places where they may be expected to live. Sev-

eral open ponds having considerable depth were stocked with these fish, and very good results were obtained, the sun-fish, indeed, seeming to have an almost insatiable desire for the wigglers. The stickle-backs also did very well. Another small fish known as the mud-minnow did good service in shallow pools where either of the other fish would have found it impossible to live.

The season has been extremely wet in Michigan and for this reason it is impossible to judge of the benefit received from this treatment. Rain fell at short intervals so that, in many places, pools remained all summer where ordinarily they dried up in June. The grass has been almost constantly wet, a condition very favorable to mosquito life, and while many millions have been killed, many have drifted in from outside. Mosquitoes were plentiful enough it is true. We can imagine how numerous they would have been if the many millions which were killed had been left to live.



Fig.2. - Mosquitoes killed by disease, nat. size, original.

DISEASE OF THE MOSQUITO.

On August 5th Mr. Barlow brought in a number of mosquitoes killed by a fungus (*Entomophthora* sp. nov.). They were very numerous on the margins of one of the pools in woodland, sometimes almost covering the pieces of bark to which they clung. In typical cases they were covered with a dense white growth, all were within a few inches of the water. This fungus was also found on several other species of flies and on a dragon-fly. All attempts to grow the fungus in the laboratory were futile. The disease was, however, spread in one instance by distributing pieces of bark covered with the dead insects into fresh colonies. It is not likely that this disease will ever prove to be very helpful. It may reduce the numbers of the pests but it will never eradicate them, and like most diseases, it works best when the victims are in the greatest numbers.

THE LONG LECANIUM AND ITS FUNGUS DISEASE.

A scale-insect, belonging to the group of soft-scales, and known as the long *Lecanium*, is long and slender as the name implies, yellowish-brown in color with blackish markings along the sides. This insect is a pest of importance in greenhouses, congregating in great numbers on its food-plants, and in our green-house threatening the death of many plants. It is, however, here attacked regularly every autumn by a fungus disease which so far reduces its numbers that no damage is done except in comparatively rare cases.

The disease proves, on growing it in cultures, to be a new species, which, therefore, has no common name. It appears as a white or yellowish growth covering the insect, in typical cases, and producing seed-like bodies or gonidia on the surface.

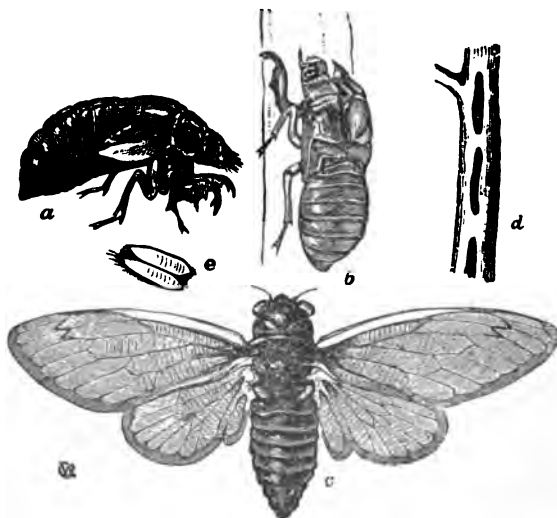


Fig. 3.—Periodical cicada, from Packard, Forest Insects, U. S. Ent. Com.

THE MAPLE COTTONY FALSE MEALY-BUG.

An insect belonging to the scale-insects and very closely allied to the mealy-bugs has appeared on the maples in one locality in Michigan. The female is white and cottony and when full-grown usually is covered with a cottony mass holding the young. The insect is usually controlled by a spray of kerosene-emulsion or by any of the contact sprays which are used in the winter time. It does not bid fair to prove a very serious enemy.

THE PERIODICAL CICADA.

This insect appeared in Michigan in the following localities: Battle Creek, Birmingham, Kalamazoo, Ann Arbor, Ypsilanti, Adamsville, Bitely, Flint, and questionably at Moorestown. No doubt they occurred in other places as well, but the above covers all the localities known either to myself or to Director C. F. Schneider of the Weather Bureau, who kindly turned over his records to me.

This interesting insect passes the long period of seventeen years under ground, in preparation for a week or so in the upper air. During its long period underground, its name and habits are almost forgotten, and when it appears at last, its story is as good as new, and its coming is dreaded in the belief that it will prove an enemy. The only damage that is done occurs when the eggs are laid. These are placed in holes bored in the twigs of trees, and sometimes twigs are killed in this way. Ordinarily, however, the damage amounts to nothing, unless it happens to be done in a very young orchard, just set out, in fact. As the insect occurs only in isolated stations in Michigan, and seems, on the whole, to be dying out, it may almost be ignored as an enemy.

THE ANGOUMOIS GRAIN-MOTH.

An enemy of prime importance, for the first time recorded in Michigan during the present season, is the Angoumois Grain-moth. An insect which is regarded as the most serious pest of stored grain in the

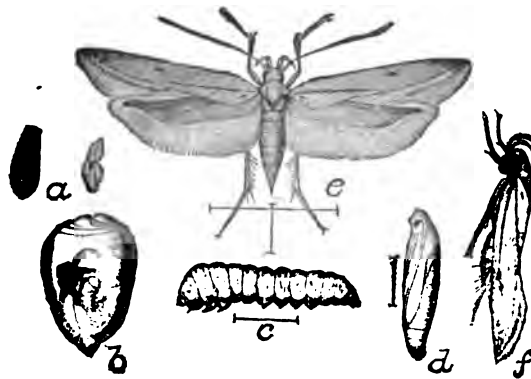


Fig. 4.—Angoumois grain-moth, from F. H. Chittenden, U. S. Department of Agriculture, Farmer's Bulletin, No. 45.

South and which bids fair to become of prime importance with us. The pest came to this country nearly two hundred years ago from France and has steadily worked its way north from Carolina, where it first made its entry.

This delicate little marauder is about the size of a clothes-moth, almost white or buff, marked with dark brown or even black. The wings are narrow and measure about half an inch or less from tip to tip when extended. It works both in the field and in the granary, eating out the inside of the berry and leaving the outside intact. It works on almost all the grains. The eggs are laid in the field for the first brood, that works in the granary, thus leaving the farmer in doubt as to the source of the trouble.

The remedy is to mass the wheat in the tight bins or sacks, and when necessary to fumigate with carbon bisulphide. Directions for fumigating will be furnished on application.

The Bulletin also contains short accounts of injury caused by the banded purple butterfly and by the hickory bark-beetle.

REPORT OF SOUTH HAVEN SUB-STATION.

BY T. A. FARRAND.

Bulletin No. 205

Prof. L. R. Taft, Horticulturist:

Sir—The following report upon the work of the South Haven Substation is respectfully submitted.

On account of excessive rains during blooming period, and some weeks later, the season has been somewhat unfavorable for fruit. Regardless of this, however, all kinds of fruit bloomed full and the peaches, pears, plums, quinces, gooseberries and blackberries bore a good crop. There was a fair crop of apples and raspberries, with a light crop of currants and grapes and almost a total failure of cherries.

The most important question in relation to the fruit industry at present is: The commercial value of this or that variety of the different classes of fruit. In view of this fact a few notes were taken as the season advanced, as to the market prices received in Chicago, Milwaukee and South Haven, the time of ripening, and the demands of the market for different varieties of the various kinds of fruits.

RASPBERRIES.

Of the black caps, Eureka and Doolittle were the best early sorts; Kansas and Mills were the best mid-season, and Cumberland and Livingston bore full crops of fine late fruit. The red raspberries bore a fair crop of fine large fruit and lasted over a long season. Marlboro made the finest showing, although Cuthbert, Early King and Phoenix were very good. Columbian and Shaffer bore full crops of fine large fruit, and the plants are hardy, vigorous and productive; fruit large and of excellent quality for culinary purposes, but as yet do not take as well on the market as the red varieties. The red raspberries brought a high price throughout the season, but the very earliest and latest ripening black caps sold for considerable more per crate than the mid-season varieties.

BLACK CAPS.

Conrath.—A well-known variety, largely planted for commercial purposes; moderately vigorous, productive and of good size. Somewhat subject to anthracnose.

Cumberland.—The best late market variety in the station collection. The plants are strong, vigorous growers and very productive; fruit of large size and good quality.

Diamond.—A medium to late-ripening variety; fruit of large size and good quality. Valuable for market.

Eureka.—The best early to mid-season variety this season. Plants moderately vigorous, very productive; berries of large size and good quality. Valuable for home or market.

Gregg.—An old, well-known market variety, and still valuable for that purpose.

Green.—Vigorous and productive; ripens early; berries small and seedy this season.

Hilborn.—Vigorous and very productive; fruit of medium size; a reliable market sort.

Idaho.—One of the best late-ripening sorts; fruit of the largest size and good quality; has proved to be a reliable variety at the station grounds, and can be safely recommended for home or market.

Kansas.—The best mid-season variety on trial this season; plants are strong, vigorous growers; fruit of large size and attractive in appearance. A valuable market sort.

Livingston.—One of the newer varieties that is proving itself worthy of a place in the commercial plantation. One of the best late-ripening sorts; bore a full crop of berries of large size.

Mills.—One of the best mid-season varieties; fruit was of large size and attractive appearance, but this variety has the reputation of not standing drouth well.

Smith (Prolific).—Considered a valuable mid-season sort; fruit of large size; quality good; plants only moderately vigorous.

RED VARIETIES.

Cuthbert.—An old, well-known market variety that still holds first place in vigor and productiveness; needs no recommendation.

Early King.—The first variety to ripen this season; fruit of good size and quality; plants only moderately vigorous. Valuable as an early sort.

Golden Queen.—Plants vigorous and usually productive; resembles Cuthbert in form and flavor; excellent for home use, but does not take well on the market.

Hansell.—An early ripening sort, but lacking in vigor and productiveness.

Marlboro.—This variety made the finest showing in the station collection this season. The fruit was of the largest size; ripened over a long season, and held its size well to the end of the season. Somewhat lacking in hardiness, but a valuable sort in some localities.

Miller.—Lacks vigor and productiveness here, but is a valuable market variety in some places.

Phoenix.—A moderately vigorous grower, which made a good showing this season. The fruit was of large size, attractive appearance and ripened over a long season.

Turner.—A vigorous grower, moderately productive of fruit of fair size and very good quality. Very hardy.

PURPLE CAPS.

While we have a large number of varieties of this class of fruit on the station grounds, and nearly all are fairly productive, only a few are worthy of mention, of which Columbian and Shaffer hold first place in hardiness, vigor and productiveness. Emmet and Redfield are good varieties, but do not equal the latter varieties. Columbian and Shaffer are valuable for home use and in markets where they are known.

BLACKBERRIES.

As a whole, the blackberry crop was very good this season. No doubt the good showing made is due to plenty of rain up to and through the time of fruiting. Like the raspberries, the very earliest and very latest varieties brought the best price on the market. Wallace and Minnewaski were the best varieties this season. Early Harvest was the most productive of the early varieties.

NOTES ON VARIETIES.

Ancient Briton.—A strong, upright grower, and quite largely planted for commercial purposes, but here the berries run small, rendering it undesirable.

Early Harvest.—A valuable early market sort, but must have winter protection to get best results.

Early King.—A valuable early market sort, and, like Early Harvest, should have winter protection.

Eldorado.—Very hardy and productive; resembles Snyder in growth of plant, but the fruit runs larger than that variety, and it is more productive here. One of the newer kinds that is considered valuable for market purposes.

Erie.—A very large berry of fine appearance, but lacks productiveness.

Kittatinny.—An old, well-known market sort, but is being largely replaced by other varieties on account of its being especially liable to the attack of red rust.

Knox.—Proves to be valuable here, although reported to lack productiveness; plants are strong and upright in growth; fruit large, attractive and of good quality.

Maxwell.—Plants lack vigor and productiveness. A failure here.

Minnewaski.—The best late-ripening variety on station grounds this season. Plants vigorous and productive; fruit of large size, and ripens over a long season. Valuable market variety.

Nevada.—This variety made a fine showing this season. The fruit was of large size and good quality; ripens late. Valuable.

Ohmer.—Fruit of large size and good quality. Valuable as a late-ripening sort.

Sanford.—Very productive, but the fruit is too small to be valuable.

Snyder.—Considered valuable in localities where great hardiness is required, but does not prove satisfactory here. Fruit is small.

Taylor.—Hardy, vigorous and productive, but fruit is too small to be a profitable market variety.

Wallace.—This has proved to be the very best mid-season variety for home or market. Plants hardy, vigorous and productive. Fruit of large size and excellent quality.

Wilson, Jr.—Plant moderately vigorous and very tender, but in some localities, with winter protection, the most profitable market variety grown. Fruit of large size and very attractive.

CURRANTS.

The currant crop was unsatisfactory this season. The stems were not well filled and the fruit was small and unattractive in appearance. They bloomed very full, but no doubt the cold, heavy rains at the time had something to do with stems not filling out. The Cherry varieties were by far the most profitable this season. While the stems were not well filled out, the berries were very large and attractive and sold for \$1.25 per sixteen-quart crate, while all other varieties ranged from 40 to 60 cents per crate, and hardly paid for the expense of handling them. For the white varieties, there seems to be but little demand, although they are of the best quality for dessert purposes. There is a good demand for black currants, but they do not seem to be popular for commercial planting.

NOTES ON VARIETIES.

Cherry.—While not so good a grower as the smaller kinds, and somewhat subject to the attack of twig borer, its large size and attractive appearance makes it a valuable market sort.

Fay.—Closely resembles Cherry, but bore a better crop of fruit this season. It is even more subject to the attack of twig borer.

Holland.—A vigorous grower, but lacking in productiveness here. Considered valuable for market by some. The plants are invariably infested with plant lice.

Lakewood.—Resembles Cherry, but has proved to be a better grower than that variety. A valuable sort for market.

Lancaster.—A white currant of good quality. Only moderately productive.

London.—Plants vigorous and very productive. Considered by many the most profitable variety grown.

North Star.—A comparatively new variety that made a good showing this season. Plants are upright, vigorous and fairly productive. Has some value as a market sort.

Pomona.—A very good new variety, but as yet does not equal some of the older varieties on trial. Clusters of medium length; fruit medium to large and of good quality.

Red Dutch.—Plants tall and very vigorous; usually productive, but the fruit is too small to be a valuable market sort.

Select.—Of the Cherry class; fruit large and handsome. Valuable.

Versaillaise.—Moderately vigorous and productive; berries above medium size. Of some value as a market sort.

Victoria.—An old, well-known variety. Plants vigorous and very productive, but the fruit is too small to be valuable as a market sort.

GOOSEBERRIES.

ENGLISH VARIETIES.

Chautauqua.—Plants vigorous and productive. Berries very large and of good quality. One of the most profitable varieties on trial.

Columbus.—Made the finest showing of any variety this season. Plants vigorous and productive; berries of large size. One of the best.

Industry.—Lacking in vigor and productiveness. Berries turn red when ripe. Not desirable.

Keepsake.—Plants vigorous and productive. Berries of the largest size; color greenish yellow. One of the very best for market.

Lancashire.—A vigorous grower and very productive. Berries of large size and good quality, but have the fault of turning red, and this is an objectionable feature in the market.

Orange.—This is the most vigorous grower, and has the finest quality of any variety on the station grounds, but too small for market. Valuable for home use.

Of the American varieties, Downing is by far the best on trial in hardiness, vigor and productiveness. Valuable for market.

CHERRIES.

The cherry crop, as a whole, was very poor this season, especially the sweet varieties; but a number of the sour kinds bore full crops. Montmorency, Weir, King, Ostheimer, Suda and Northwest were the most productive. Of the Duke class, Magnifique, Montrueil and Carnation were best, as were Napoleon, Windsor, Baltavar and Mary Kirtland of the sweet varieties. The cherry seems to sustain greater loss from cold or heavy rains, while in bloom, than any other fruit. Many complaints come to the Station from this locality and different parts of the State of the leaves turning yellow and falling from trees in July. This was not so of the trees on the station grounds, and it is evident from results obtained here that two or three thorough applications of Bordeaux mixture is effectual in holding the leaves on the trees. Commercially, no satisfactory results were obtained from the sweet kinds; but with the sour varieties the prices advanced with the season, Dyehouse and Richmond selling for \$1.00 per crate; Montmorency, \$1.25 per crate; and Suda, Ostheimer, Northwest and Wragg, one week later, at \$1.40 per crate. While without doubt Montmorency is the most profitable variety grown at present, with the large acreage already out, it would seem advisable to plant more of the later kinds.

MORELLOS.

Brusseler Braune.—Tree an upright, vigorous, handsome grower. Fruit very large, attractive and of excellent quality. A fine late cherry, but has proved unproductive here.

Dyehouse.—If anything, ripens a little in advance of Richmond, but is not so vigorous as that variety, although fully as productive.

King.—Tree vigorous and productive; ripens with Richmond, and it seems fully equal to that variety.

Minnesota.—A late-ripening variety of some value for market. Fruit above medium in size; color dark red; quality good.

Monarch.—Supposed to be a new variety, but seems identical with Montmorency here.

Montmorency.—The most profitable and most largely planted sour cherry.

Northwest.—Trees low, spreading, dwarfish in habit; lacking in vigor, but very productive. Valuable as a late ripening sort.

Ostheimer.—Seems identical with Suda, and with that variety the most profitable late-ripening sort. Fruit medium to large; dark red; heart-shaped.

Richmond.—One of the most profitable early market varieties grown. Vigorous and productive.

Suda.—Very productive. Fruit large, dark red, heart-shaped; ripens late in the season. One of the best.

Weir (No. 2).—A strong, vigorous grower; very productive. Fruit large, but a little light in color; ripens a little in advance of Richmond and excels that variety. A valuable early market sort.

Wragg.—Very productive. Fruit large, dark red, and ripens late. Valuable as a late market sort.

DUKES.

Carnation.—One of the best Dukes on trial. Tree vigorous and fairly productive. Fruit large, dark red and of very good quality.

Magnifique.—The best Duke on trial this season. Fruit of large size and good quality; rather light in color. Valuable as a late-ripening variety.

Montrneil.—The very best all-round Duke. Fruit very large and of the best quality; color dark, rich red. Tree vigorous and productive. Valuable for home or market.

White Bigarreau.—So named, but between the Duke and Morello in type. Received from the Division of Pomology in 1895. Tree a rather slow grower, forming a low, round, bushy head. Fruit large and of good quality; color very light red, with a shade darker on one side; very tender, juicy, with sprightly sub-acid flavor. Requires further trial.

HEARTS AND BIGARREAUS.

Badacsony.—Of Hungarian origin. Tree lacks vigor and is only moderately productive. Fruit large, very firm; dark, rich red in color; quality only fair. Not desirable.

Baltavar.—Fruit large, firm and attractive in appearance. The most promising of the three Hungarian varieties—Badacsony, Baltavar and Mednyansky—received from the Division of Pomology.

Cleveland.—A very strong grower and quite an abundant bearer. Fruit large; light yellow, shaded with red; quality fair.

Ida.—A very large, light-colored cherry of very good quality. Rather tender for distant markets. Valuable as an early sort for home use.

Mednyansky.—Of Hungarian origin. A moderately vigorous, spreading grower. Fruit medium to large; very dark, almost black, in color; quality only fair. Too low in quality for home use, and not quite productive enough for market.

Napoleon.—Considered one of the most profitable market varieties grown. Vigorous and very productive. Fruit of large size and attractive in appearance. Bore the heaviest crop of any variety of sweet cherries on trial this season.

Plymouth Rock.—A new variety that as yet does not excel other older varieties. Trees vigorous and productive. Fruit of medium size and good quality.

Rockport.—Of large size, attractive in appearance and very good quality. Moderately vigorous and productive.

Yellow Spanish.—An old, well-known variety that is still a valuable sort for home use or market.

Windsor.—Tree vigorous and productive. Fruit large, heart-shaped; color dark red; quality very good. One of the most valuable varieties for home or market.

Wood.—A very good early variety. Fruit of medium size; color light yellow, shaded with red; tender for distant market, but valuable for home planting.

PEACHES.

There was a heavy crop of peaches. The fruit was large but not so good in quality, and somewhat lacking in color, especially the late-ripening varieties, which was due no doubt to excessive rains and lack of sunshine.

SPRAYING.

A comparative test was again made to determine how late in the spring the spraying can be done for "leaf-curl," and satisfactory results secured. One-half of the trees of each variety were sprayed April 1, with two pounds of copper sulphate to fifty gallons of water, and the remainder were sprayed, April 15, with the same solution (except one tree in each block left unsprayed). The following results were noted: All trees sprayed April 1 were free from "leaf-curl." Of the trees sprayed April 15, a large number were quite badly affected, and all trees left unsprayed were so badly injured that they lost nearly all of their foliage.

For the control of brown rot, after the fruit had set, all trees were sprayed with a weak solution (three-fifths strength) of Bordeaux mixture and arsenite of lime. Later, trees of the earlier ripening varieties were sprayed with a solution of three ounces of copper sulphate to fifty gallons of water at intervals of ten to fifteen days, until the fruit ripened. The result was that very little rot made its appearance. Amsden, Triumph and Barnard being slightly affected, and the later peaches not at all. It is very necessary to do the spraying thoroughly to obtain the best results.

PRUNING.

Late in the fall of season of 1900, a number of trees were pruned to determine whether there would be any injurious effects on fall-pruned trees. There was no difference noticeable the following season, but when the trees were pruned this year it was noticed that the wounds, from heading back and thinning out branches, had dried out, and in some instances killed back instead of healing over, as they do if pruned in the spring, when the sap is flowing.

In view of this fact, it would seem that the best time to prune is early in the spring, before or at the time the sap begins to circulate.

THINNING THE FRUIT.

A thinning test was started this season, to last over a period of three years. Of one lot, one tree was thinned to eight inches; one was thinned to four or five inches, and one tree was left unthinned. Of the other varieties, one tree was thinned to eight inches and one tree unthinned. It was noted at the end of the first season's test that all trees severely thinned were much thriftier and their foliage much healthier, and did not fall from the trees as early in the season as on unthinned trees; that peaches taken from the thinned trees sold for nearly double as much as those from unthinned trees.

The varieties chosen for the test happened to ripen at a time when there was a good demand, otherwise peaches from unthinned trees would have been unsalable. From a commercial standpoint, the benefits from heavy thinning were very apparent.

MARKETING.

Of the yellow varieties, Engle Mammoth is the most profitable variety on station grounds, Salway ranking next, with Ford New, Kalamazoo, Brunson, McCollister, Smock, Willett and Gold Drop following closely. The Elberta trees have been removed, and it was not considered in the above statement. Although somewhat tender in fruit bud and rather inferior in quality, this variety is in large demand and commands the highest market price, and it is considered one of the most valuable varieties for commercial planting. Smock has usually been a very profitable sort, but this season it was far from satisfactory, owing to the conditions at the time of ripening.

Much depends upon the size of the fruit and the packing. As a rule, white varieties have not been satisfactory, and many growers have removed them from their orchards, while very few are being planted; and yet the better white varieties grown at the station grounds, well packed in open-slat, one-fifth bushel baskets, sold for a higher price than many of the later yellow varieties on the Chicago market.

NOTES ON NEW VARIETIES.

Advance.—Size medium to large; color white, with red cheek; quality fair; ripens the middle of August. Will require further trial. Semi-cling.

Banner.—Ripened a few fruits for the first time, this season, from trees planted in 1899. Of medium size; yellow, with slight red cheek; ripens with Smock, but is of better quality than that variety. Will require further trial.

Capital.—Size medium to large; color yellow, with very faint tinge of red; resembles Smock somewhat and ripens with that variety. Fruit is dry, mealy and not so good in quality.

Clifton.—Ripened a few fruits this season from trees planted in 1900. A white-fleshed peach of medium size and fair quality. Ripe August 23. Freestone.

Delaware.—A handsome, large-sized, white-fleshed peach of good quality. Ripens in early September. It is doubtful if it proves of value, coming at that time and being white-fleshed.

Emperor.—A medium-sized, yellow-fleshed freestone of only fair quality. Ripens with Smock. Requires further trial to determine its value.

Eureka.—Ripened a few fruits for the first time, this season, from trees planted in 1900. Color white, with red cheek; form long, compressed, of Elberta type; texture tender, juicy; quality good. Semi-cling. Ripens just before and with Lewis.

Sneed.—The earliest-ripening variety tested. A semi-cling, medium-sized, white, of fair quality. Of some value for local market.

Waddell.—The most promising new white-fleshed peach. Of medium to large size; color creamy white, with handsome red cheek. Rather tender, but of very good quality. Ripens just before Lewis.

Zea.—Ripens with Waddell and is large and attractive, but is not as good in quality nor as productive as that variety.

Wark.—Resembles Triumph in form, color and quality, and is also semi-cling. Ripened a few fruits from trees planted in 1900; a few days later than Triumph, but on older trees will probably ripen with that variety. Will require further trial.

NOTES ON OLDER VARIETIES.

Allen.—Of large size and good quality. Resembles Jacques Rareripe, but lacks the productiveness and hardness of that variety.

Amsden.—It is no doubt desirable to have a few trees of this variety for home use, but from a commercial standpoint it is a damage to the peach industry of Michigan. It comes in competition with the fine yellow freestones from the South, and every year the market bulletins quote them as "the hard, green, white clingstones of poor quality from Michigan." It rots badly on the trees and in transit to the market.

Barnard.—An old, well-known variety at one time very largely planted for commercial purposes; ripens with Engle Mammoth, but is far less valuable than that variety.

Bequette.—A white peach of the Elberta type, ripening with that variety. Of the largest size, vigorous and productive. The most desirable white peach at that season.

Bishop.—Ripens just before and with Lewis, and is a larger and finer-looking peach. A desirable variety.

Brunson.—Resembles Kalamazoo, although a distinct variety. Ripens just before and with that variety, and is fully equal to it.

Champion.—A valuable market variety. Of the largest size and best quality, but too tender for long-distance shipping. Color creamy white, with handsome red cheek; season, early September.

Connett (Southern Early).—A large, handsome, white peach. Ripens, if anything, a little ahead of Lewis. Is entirely free from rot and is to be preferred to that variety. Valuable as an early market sort.

Crothers.—A medium to large, attractive, white-fleshed freestone peach of good quality; ripens just before Smock. Valuable where a white-fleshed variety is desired.

Ede (Captain).—Resembles Elberta in shape, color and flavor but is smaller, ripens a few days earlier and is not as valuable as a market sort.

Engle Mammoth.—The very best peach of its season. Of large size, attractive appearance, best quality, and very productive.

Ford, New.—Ripens with and resembles Engle Mammoth, and seems to be fully equal except in quality.

Ford 1.—An attractive, white-fleshed peach of good quality; seems worthy of a place in the commercial orchard; ripens just before Lewis; is entirely free from rot and very productive.

Ford 2.—A late-ripening peach of large size and good quality. Unproductive; valueless.

Ford 3.—A late-ripening, white-fleshed peach of poor quality. Not valuable.

Ford Red.—An attractive, white-fleshed peach ripening in early September; productive, but less profitable than the yellow varieties ripening at that time.

Gold Drop.—Hardy and productive to a fault. It has been one of the most profitable varieties grown, but is now less highly esteemed except when heavily pruned and thinned.

Greensboro.—Ripens with Rivers and does not excel that variety. Not particularly desirable.

Gudgeon.—A very large, late, white peach of low quality. Not desirable.

Haas.—Ripens with Hale and is practically identical with that variety.

Husted (101).—A medium to large peach resembling Chili in appearance, but ripens a week to ten days earlier. Of some value as a market sort; a good record here.

Ice Mountain.—Of no value here; always sets a full crop but have been frozen until this season when a number of baskets were picked on December 1. Of medium size; color, clear, rich yellow; a freestone; of poor quality. The fruit kept in the cellar until January.

Iron Mountain.—A late-ripening white peach of low quality. Worthless.

Jersey Yellow.—Of Smock type and season, and no improvement on that variety. Inclined to be unproductive. Valueless.

Juno.—A late-ripening yellow clingstone of poor quality; ripens with Smock. Not valuable.

Kalamazoo.—A very profitable market variety which should be largely planted. Well liked by canning factories. Vigorous and usually productive.

Lafayette.—Of medium size and attractive in appearance. Bearing at the time it does, with Hills Chili, it is not likely to prove of much value.

La Fleur.—An attractive fruit; ripens with Chili, but is less productive than that variety.

Lemon Free.—A large, greenish-yellow peach; ripens with Smock, not as attractive in appearance but hardier and more productive. Considered by some a valuable late market variety.

Lewis.—Has been a very profitable market sort, but rots badly.

Longhurst.—Of the Chili type and season. Seems to be an improvement, being smoother, larger and higher colored.

McCollister.—Of the largest size, attractive in appearance and of good quality; ripens just before Smock and is a valuable market variety.

New Prolific.—Bore a full crop of fine-looking peaches this season; ripens with Engle Mammoth; equaled that variety in every way this season except in productiveness.

Oceana (Husted 130).—One of the newer varieties; ripens just before Engle Mammoth. The fruit is large, yellow with red cheek; of very good quality. Seems to be a valuable variety for market purposes.

Red Cheek.—An old, well-known variety, well spoken of by some growers. Of large size; color yellow, highly colored; of good quality. Ripe September 22. Fairly productive.

Salway.—By far the best variety of its season on the Station grounds; large, yellow, with red cheek, and of very good quality; usually productive. A valuable market variety.

Smock.—An old, well-known variety. Beer's Smock, Hance Smock and Smock are identical here.

Stevens Rareripe.—A large-sized, handsomely colored white peach of good quality; ripens in late September. Valuable where a peach of that class is desired.

St. John.—Of large size; very handsomely colored and of excellent quality. Considered by many as a valuable market variety. Lacks in productiveness here.

Triumph.—Hardy, vigorous and very productive, inclined to overbear; requires heavy thinning and pruning or the fruit will be small. Inclined to rot. It is a semi-cling but can be safely recommended for planting on a small scale.

Willett.—Practically the same as Longhurst; of the Chili type; hardy and very productive. Fruit highly colored, of medium to large size and very good quality.

Worthen.—Of large size, handsomely colored, and of excellent quality. Of the Crawford type, but seems to be more productive than that class usually is.

PEARS.

The pear crop this season was a heavy one and exceptionally free from worms and scab. In spraying they received the same treatment as the apples. Fancy Duchess and Bosc brought the highest price of any varieties grown on the Station grounds, selling for \$1.35 per bushel in Milwaukee. The opinion of most of the pear growers in this locality is that Bartlett still has the lead, and canning factories will take nothing else when they can get them. Bosc, while not so largely planted, nor so well known, commands the highest market price. Does not come in bearing as early as some varieties, but is a heavy and an annual cropper as the trees increase in age. As to Kieffer, opinions vary greatly. While many consider it one of the most profitable varieties grown, there are many others who do not think so favorably of it; but while it may not be quite so largely planted in the future as in the past, it has come to stay and will see its seasons of great profitableness.

NOTES ON VARIETIES.

Angouleme (Duchess).—One of the most profitable late fall market varieties. Of the largest size; quality good; color yellow.

Anjou.—A fine late fall pear, but slow in coming into bearing. Color yellow with a brownish-red cheek. October and November.

Ansault.—An early and an abundant bearer. Ripens just before Sheldon and resembles that variety. An excellent variety for home use.

Barry.—A winter pear of large size but rather low quality. Color, cinnamon russet; attractive in appearance; seems to lack productiveness.

Bartlett.—An old standard variety; well known.

Bloodgood.—A valuable early ripening variety of medium size and excellent quality. Color yellow with brownish-russet blotches. Ripens in August.

Bosc.—Of large size; very best quality and a handsome golden-russet color. Rather slow in coming into bearing, but considered a valuable late fall market variety.

Boussock.—A large pear of good quality. Ripens in early September.

Dana Hovey.—Equals Seckel in every way. Ripens later than that variety and is worthy of a place in every garden.

Drouard.—Ripened its first fruit this season from six year old trees. Form obovate, pyreform; color yellow, sprinkled with many russet dots; texture firm, breaking, granular; quality only fair. Season December-March.

Early Duchess.—A new variety. Resembles Angouleme in form and color, but has a much smoother surface. Ripens three weeks earlier. Bore a full crop this season and promises to be very productive and valuable.

Elizabeth (Manning).—A handsome little dessert pear ripening in the middle of August. Tree is a fine, shapely grower and very productive.

Esperen.—A late-ripening variety of rather small size and of only fair quality. Not desirable.

Fitzwater.—Size medium to large; color yellow with russet markings; quality good. Ripens in October; bore a heavy crop this season, and should it continue to do so. will be a valuable variety for market.

Flemish Beauty.—Considered by those who do not spray as worthless on account of its scabbing and cracking, but on the Station grounds is a profitable market variety.

Fred Clapp.—Of medium to large size; yellow with brown patches; of good quality and productive; valuable fall variety for market or home use.

Gansel Seckel.—Bore a full crop this season; fruit small, irregular; of good quality but not rich; unattractive in appearance and not promising for market.

Giffard.—Of medium size, good quality and productive. Ripens in early August and seems valuable for market. Color greenish yellow with brownish red cheek.

Groveland.—A late fall variety of large size and good quality. Resembles Anjou in color and form. Unproductive as yet.

Howell.—An early and abundant bearer. Medium to large size; color yellow; of fair quality; a valuable market variety.

Kieffer.—Hardy, vigorous and very productive of fruit of good size and attractive appearance. Quality low, but a good keeper and a long distance shipper. A standard variety.

Kraus 41.—Size medium; color yellow; quality low. Ripens late August. Not valuable.

Lawrence.—A late fall and early winter variety; color greenish yellow with russet markings; quality very good. Grown to some extent for market.

Longworth.—Tree vigorous and productive, but too poor in quality to be valuable.

Mt. Vernon.—Tree vigorous and productive of fruit of medium size and fair quality; color yellow, overlaid with cinnamon russet, brownish-red cheek. Ripens in late October. Of value as a market sort.

Pitmaston.—Of very large size and good quality; color clear yellow, very attractive in appearance. A desirable market variety if it proves productive. Ripe October 15.

President.—Of very large size and good quality. Not as attractive as Pitmaston. Color yellow, with many russety dots and markings. If productive with its large size will be a valuable market variety.

Reeder.—A smooth, fair-growing pear, resembles Howell, but ripens in late October. Of good quality; medium size, and bore a heavy crop this season. A promising variety for market.

Rostiezer.—Of small size and rather unattractive appearance but of excellent quality. A fine dessert pear. Season late August.

Rutter.—Of large size; color yellow, dotted and netted with russet; quality good. Bore a full crop this season; a promising market variety. Ripe October 15.

Seckel.—An old well-known variety; valuable for dessert and market; bore a heavy crop this season and fruit was unusually large in size.

Sheldon.—Of medium to large size; color russet; form round; quality excellent, tender, very juicy, rich. Considered a valuable fall variety for home or market.

Souvenir (du Congress).—Of the largest size; clear yellow; good quality, has a Bartlett flavor. Bore a full crop this season. Promising as a market sort.

Tyson.—Of small size and excellent quality; pyriform; color yellow, russeted. Trees vigorous, but are 14 years old and bore a few fruits for the first this season. Not promising.

Winter Nelis.—Fruit small; color yellow, russeted; texture tender, melting, buttery, with a rich, sweet flavor; quality good. Considered one of the best winter varieties.

NEW VARIETIES.

Conference.—Ripened a few fruits for the first time this season on four-year-old trees. Fruit of medium to large size, obtuse pyriform; color greenish yellow with russety blotches and markings; flavor sweet, rich; texture tender, melting, very juicy and of the highest quality. Promising but requires further trial. Ripe October 5.

Kraus 18.—Received from C. F. Kraus, N. Y., in 1895. Bore a fair crop of fruit for the first time. Size medium to large, with a very handsome red cheek; form obovate, obtuse, pyriform; flavor rich, vinous, perfumed; texture tender, buttery, melting; quality very good. Promising, requires further trial. Ripe September 5.

Louise (Bonne de Jersey).—An old, well-known variety. Ripened a number of fine specimens on trees planted in 1900. Size medium to large; color greenish-yellow with brownish-red cheek, and sprinkled with many reddish dots; quality good. Trees quite productive. A valuable market variety.

Garber.—Bore a full crop for the first this season on trees planted in 1892. Of the Kieffer type in texture, color, quality and growth of trees, but has lacked the productiveness of that variety. Considering the length of time that it has taken this variety to get into bearing, it does not seem a promising variety. With its low quality it would need to be an early and an abundant bearer to make it a profitable market variety.

Magnate.—Ripened a few perfect specimens for the first this season on trees planted in 1898. Size medium to large; form obtuse-pyriform; color yellow with red cheek; flavor vinous, pleasant; texture tender, juicy, melting; quality very good. Ripe October 1. Promising, but requires further trial.

PLUMS.

There was a good crop of plums this season and they were quite free from rot. The trees were sprayed early in April with copper sulphate, two pounds to fifty gallons of water. Immediately after the blossoms had fallen, they were sprayed with Bordeaux mixture and arsenite of lime, and this was repeated at intervals of six to ten days until they had received four applications, after which weak solutions of copper sulphate (three ounces to fifty gallons of water) were applied every week until the fruit began to ripen.

THINNING.

One tree each of a few varieties were thinned this season to determine, if possible, the value from a commercial standpoint and in helping to control the brown rot. The fruit was thinned so as to leave as much fruit as was possible on the tree, and yet not come in contact when fully matured, with the following results: The fruit was much larger where thinned and at all times brought a higher price from being such, and it certainly rotted worse where left in large bunches than when thinned. It was also noticed that the trees did not drop their foliage as early in the season. Observations will be taken next season at the time of the blossoming and setting of the fruit to determine if there be any further effects.

MARKETING.

To determine if there are any points of commercial value in the use of different kinds of packages for shipping this fruit, the following test was made on the same day and to the same commission house: The following packages were packed and shipped (variety Red June), one sixteen-quart case (the fruit in quart boxes), two one-fifth bushel baskets, and one four basket crate, such as is used for tomatoes. By actual measure, the two one-fifth bushel baskets equaled the one four-basket crate, with a difference of five quarts between those packages and the sixteen-quart case. The following sales were made: One dollar for sixteen-quart case, one dollar for four-basket crate, and 35 cents each for the two baskets, or 70 cents for the two one-fifth bushel baskets. Thus the sixteen-quart crate and the two one-fifth bushel baskets brought the same price per bushel of fruit, while in a four-basket crate it brought nearly fifty per cent more, a difference of seventy-five cents per bushel in favor of the four-basket crate. The fruit in all of the packages was first-class.

Observations made with other fruits would indicate that the four-basket crate is especially adapted to first-class fruit, while the second-class fruit is best handled in the one-fifth bushel basket, also that small Damson plums are best handled in the sixteen quart crates. Red June is proving to be one of the most profitable varieties on the Station grounds on account of its earliness and productiveness. The Damson plums brought nearly double the price of other varieties.

MARKET VARIETIES.

European.

The following varieties are proving to be the most profitable varieties on the Station grounds: Bradshaw, Black Diamond, Kingston, Grand Duke, Lombard, Monarch, Fellenberg and Giant Prune.

Japan Varieties.

Red June, Abundance, Burbank and Satsuma.

NEW VARIETIES.

America.—A native plum that ripened a few fruits from trees planted in 1900. Of small size; form roundish-oblong; color light red; texture tender, juicy; flavor sweet, bitter next to skin and pit; of only fair quality and a clingstone. Coming as it does with fine European varieties, it does not seem promising. Ripe August 20.

Clyman.—Originated on the farm of Mrs. Clyman in Napa valley, California. A European plum of medium size, roundish inclining to oblong; color blue with a light blue bloom; texture firm, moderately juicy; flesh yellow; quality good. Ripe August 24. Promising if it proves productive.

Splendor.—Of medium size; of prune type, long, oval, compressed with neck, suture indistinct, cavity broad, of medium depth; color blue with blue bloom; flesh yellow, firm, only moderately juicy; sweet, rich, mild; quality very good; freestone; pit long, narrow, flat. Ripe September 5.

Muscat Free.—Ripened a few fruits for the first this season. Is of the German Prune type; long, oval, compressed, sometimes with neck; of medium size; color dark blue with blue bloom; texture firm, rather dry; flavor rich, sweet; color of flesh greenish-yellow; quality good. Ripe September 5. Requires further trial.

Quetsche Freestone.—Of the German Prune type. Bore a full crop this season. Fruit below medium in size; color dark blue with thick blue bloom. Form long, oval, compressed; suture distinct; texture firm, juicy with brisk sub-acid flavor; flesh yellow; quality fair. Ripe September 13. Promises to be productive but of rather small size. Requires further trial.

NOTES ON OLDER VARIETIES.

European Plums.

Agen Prune.—Of medium size, dark purple; quality very good. Season early September. Moderately productive but not quite large enough for best market results.

Arch Duke.—Of large size and excellent quality. Ripens a few days earlier than Grand Duke, but is less productive.

Arctic.—A small to medium, dark blue plum of fair quality; unproductive. Not valuable.

Aubert.—Practically identical with Yellow Egg. Moderately productive. Valuable for market and home use.

Bavay.—A medium-sized greenish-yellow plum of the very best quality. Valuable for home or market. Ripens in late September.

Bradshaw.—Very large, reddish-purple, of good quality. Bore a heavy crop of fine plums this season. Ripe middle to last of August. A valuable variety for home and market.

Burbank No. 7.—Of medium to large size; yellow; of excellent quality. Tree a vigorous grower, but is rather unproductive. Ripens in late September.

Coe (Golden Drop).—A very large plum of good quality. Ripe late September. Lacks productiveness.

Czar.—A medium-sized, dark blue plum of fine quality, but unproductive.

Black Diamond.—Practically identical with Kingston, and with that variety, one of the most profitable kinds on the station grounds. Very large, blue black, handsome, rather tart for dessert purposes, but a fine canner; very firm and productive. Quite free from rot.

Fellenberg (Italian Prune).—Tree low, spreading, productive; fruit long, oval, one side enlarged; suture distinct one-half around; color dark blue or black; flesh greenish-yellow; moderately juicy, sweet. Ripe last of August. Valuable for home or market.

French Damson.—Somewhat larger than Shropshire Damson, and brought a higher price, but as yet is rather a shy bearer.

Giant Prune.—Bore a heavy crop of large, attractive fruit this season which sold well; quality good. Until this season had not been very productive.

Grand Duke.—Very large, attractive; very firm; nearly free from rot. Being very productive and ripening late, this plum is especially valuable as a market variety.

Kingston.—Very large, blue black, attractive and very productive. Excellent for market planting.

Lincoln.—A very large plum of good quality. Ripens in early August. Valuable for home use, but rather tender for market.

Lombard.—Probably more largely planted in Michigan than any other variety. Is in demand for canning purposes. Quite subject to rot.

Monarch.—A large, dark blue, handsome plum. One of the latest ripening and most profitable plums. An early and abundant bearer.

Murdy.—Of large size, handsomely colored and very good quality. Tree rather a slow grower. Ripens in early September. Moderately productive. A good home or market variety.

Shropshire Damson.—Very small, brings the highest market price. Largely grown and a valuable market variety.

Spaulding.—A medium-sized, greenish-yellow plum of good quality; moderately productive. An excellent variety for home use. Ripens in late August.

Victoria.—Vigorous, very productive, of large size, handsome appearance and good quality. This variety, and Lombard, rotted worse than any other, especially on trees unthinned.

White Queen.—Of large size; color whitish-yellow, mottled with red, and well-covered with a whitish bloom; tender, juicy, of very good quality. Ripe August 22. Lacks productiveness as yet.

Japan Plums.

Abundance.—One of the best known varieties and a valuable early market sort. Ripens ten days later than Red June. Very productive.

Babcock.—A medium to large plum of attractive appearance; color yellow, overlaid with reddish-purple; quality fair. Ripens a few days later than Burbank. Requires further trial.

Berckmans.—Of large size; color dark red, with many yellow dots; quality low. Ripens with Burbank, but is far from being equal to that variety here, as yet.

Burbank.—Vigorous and very productive. When well thinned, large and attractive in appearance; quality good. A better shipper than Abundance. One of the best Japan varieties on trial.

Hale.—Of medium size; color pale yellow; texture tender, very juicy; flavor sweet at first, but bitter, unpleasant next the skin and pit.

Maru.—Of medium size; quite productive, but too low in quality to be valuable. Not desirable.

Ogon.—A large-sized, clear yellow, early ripening plum of rather low quality; unproductive. Not valuable.

Red June.—The most profitable early-ripening plum on trial. Begins to ripen ten days before Abundance, and lasts until that variety comes on the market. Of medium size; color clear red; quality good. Productive and entirely free from rot.

Satsuma (Blood Plum).—Of large size and attractive in appearance; color dark reddish-purple, with dark purple flesh. Tree vigorous, upright, spreading grower and an abundant bearer. A valuable variety for culinary and market purposes.

Yosebe.—The earliest ripening variety on the station grounds. A small red plum of poor quality. Lacks productiveness. Not valuable.

GRAPES.

The crop of grapes, taken as a whole, was light although most of the standard varieties made a good showing. Among the best were Campbells Early, Delaware, Diamond, McPike, Worden, Jessica and Guinevra. Of the Rogers hybrids and other crosses, Agawam, Iona, Jefferson, Vergennes and Ulster made a good showing. A small amount of anthracnose and rot made its appearance on a few varieties, but all kinds were entirely free from mildew. The Delaware is one of the most profitable varieties on the station grounds; the small four-pound baskets selling for the same price as the eight-pound baskets of large blue grapes.

NOTES ON VARIETIES.

Agawam.—Bore a fine crop this season. Fruit large; light red and of fine quality. It sometimes mildews badly and lacks in productiveness. Desirable for home use.

Brighton.—A well-known grape of the best quality. Valuable for home or market.

Campbell.—One of the newer varieties of the Concord type. Ripens two weeks before that variety and this year was more productive. The

bunches and berries are large and hang on the stem long after ripening. Quality very good. Valuable for home and market.

Colerain.—A white Concord seedling; vigorous and moderately productive; quality very good.

Concord.—The most valuable market variety. Does not do as well as Worden here.

Delaware.—For a number of years this well-known variety has been quite productive and it is certainly one of the most valuable varieties on trial. Excels both for market and dessert purposes.

Diamond.—A white grape of very good quality. Ripens just before Concord. The vine is vigorous and more productive than Niagara. Valuable for home or market.

Diana.—A late ripening variety and a long keeper; color light red; quality good. Lacks productiveness.

Duchess.—White, of good quality; keeps well. A good home variety.

Empire State.—A white grape of very good quality. Vine vigorous, moderately productive. Valuable for home use.

Esther.—A white grape of fair quality and attractive appearance; quite productive; bunches usually of good size and well filled. Ripe October 1.

Guinevra.—A white grape received from C. Engle of Paw Paw. Made a good showing this season. Vine vigorous and productive. Bunches large, compact, of very good quality. Valuable for home and market. Ripens with Concord.

Hosford.—A black grape of fair quality. Ripens early but is unproductive. Not desirable.

Iona.—A late ripening, red grape of fine quality; quite productive but ripens unevenly. Valuable for home use.

Isabella.—A late ripening black grape of good quality; unproductive. Not valuable here.

Jefferson.—Bore a full crop this season. A late ripening red grape of fine quality. Keeps well; valuable for home planting.

Josselyn 5.—Color white; quality good; quite productive. Ripens in late September.

Josselyn 9.—A dark grape of low quality. Worthless.

Josselyn 10.—Color black; unproductive. Not valuable.

Lyon.—Vigorous, moderately productive; color white; of fair quality. Not valuable here.

McPike.—Vine vigorous and quite productive. A seedling of the Concord. Ripens a few days earlier but does not equal that variety in size of bunches and berries.

Moore Early.—An early ripening black grape of good quality. Rather unproductive.

Moyer.—A small, dark red grape of good quality, but is too unproductive to be valuable.

Niagara.—Well known and more largely planted than any other white grape. Valuable for home or market.

Pocklington.—A well-known white grape which made a good showing here this season. Ripens in early October.

Salem.—A large red grape of fine quality. Rather unproductive. Valuable for home use.

Telegraph.—Moderately vigorous, very productive. Bunches small, very compact. Color black, quality poor.

Triumph.—Vines vigorous and very productive of bunches of the largest size and attractive appearance. Color greenish-yellow; quality very poor. Ripens late.

Ulster.—Vine moderately vigorous, very productive; inclined to overbear and not ripen its fruit well. If one-half of the bunches are pinched off early in the season, the results will be more satisfactory. Bunches small to medium in size, compact; color red; quality fine. Valuable for home use.

Vergennes.—A late ripening red grape of good quality; moderately vigorous and quite productive; somewhat subject to anthracnose. Valuable for home use.

Worden.—One of the most profitable varieties on trial. Vine hardy, vigorous and productive. Ripens a few days earlier than Concord and excels that variety in productiveness and quality.

APPLES.

The apple crop was very good this season. One-half of the trees were sprayed early in the season with copper sulphate, two pounds to fifty gallons of water, and the remainder were sprayed just before the blossoms opened with Bordeaux mixture, as a comparative test in controlling the scab of apples and pears. The results were not as satisfactory as in former tests, as but little difference could be seen in amount of scab on trees sprayed early and those sprayed just before blossoms opened. In past seasons, more beneficial results were noted on trees sprayed just before blossoms opened, than those sprayed earlier. All of the trees were sprayed with Bordeaux and arsenite of lime, within a week after blossoms had fallen, and, at intervals of ten to fifteen days, two more applications were made. As a whole, the results of spraying for scab and codling moth were satisfactory as the apples were unusually free from worms, and while a few varieties were somewhat affected with scab, most of them were absolutely free from disease. There was no difference noticeable in amount of wormy fruit on trees sprayed July 25 and August 5, for the control of the later broods of codling moth, and those sprayed earlier. The fruit sprayed August 5 and picked October 10 had to be brushed with cloth before it was salable which, of course, is an objectionable feature in late spraying. Oldenburg and Jonathan brought the highest price on the market this season.

NOTES ON NEW VARIETIES.

Barry 5.—Oblate, conical, irregular; medium size; yellow with russet markings; flesh firm; quality rather low. Season October to December. Requires further trial.

Blue Anis.—Below medium in size; form oblate-conical; color yellow, striped and splashed with light and dark red, with thin blue bloom; flavor mild; quality fair. Requires further trial.

Buckskin.—Of small size; roundish-conical; yellow with light red blush; mild sub-acid; quality good. November to March. Not promising.

Egyptian.—Of medium size; oblate, irregular; clear, deep yellow; firm, fine grained, moderately juicy; flavor sub-acid; quality fair to good. December to April. Requires further trial.

Flory Bellflower.—Medium to large size; form roundish-conical; color rich yellow, with minute raised russet dots; flavor sub-acid, moderately juicy; quality good. October and December.

Gideon Sweet.—Of medium size, roundish-oblong; color yellow, striped and splashed with red; mild not distinctly sweet; firm, fine grained, not juicy. November to March. Requires further trial.

Glowing Coal.—Of large size; roundish inclined to oblate; color yellow, overlaid, striped and splashed with red; resembles Gravenstein in both fruit and growth of tree. Season middle of September. Will be valuable if it proves productive.

Greenville.—A seedling of the Maiden Blush and resembles that variety somewhat; of medium size; yellow with red cheek; firm, crisp, juicy, fine grained with mild sub-acid flavor almost sweet; quality very good. November to March.

Hamilton (Black).—Above medium in size; roundish, irregular, somewhat ribbed; yellow, overlaid and splashed with reddish-purple; tender, breaking, juicy, sub-acid; quality good. September and October.

Hungarian.—Medium to large in size; oblong inclining to conical; color yellow, with dark red blush on side exposed; attractive in appearance; firm, fine grained, breaking with mild, almost sweet flavor; quality very good. Season December to March. Promising. Received from Division of Pomology.

Kraus.—Of large size; form oblate-conical; color yellow with faint tinge of red on the side exposed to sun; firm, crisp, juicy; flavor sub-acid; quality fair. November-March.

Lady Sweet.—Above medium in size; oblong-conical; color yellow, striped and splashed with red; flavor sweet, rich; firm, fine grained; quality very good. November to February.

Looker (crab).—The latest ripening crab-apple tested. Of medium size; oblong; color yellow, washed and striped with red; flavor brisk, spicy, sub-acid; firm, crisp, juicy; quality very good. Season late September. Promising.

McLellan.—Of medium size; roundish oblate-conical; color yellow, striped and splashed with red; flavor, mild sub-acid; crisp, tender, juicy; quality good. Season December to March.

McMahon (White).—Of large size; roundish to oblate-conical; color yellowish-white, very handsome appearance; tender, fine grained, with brisk, high flavor; quality best. October to January. Promising.

Mexico.—Medium in size; form roundish-oblate; color yellow overlaid with light and dark red; tender, fine grained, with mild, pleasant flavor; quality fair. Ripe September 1.

Nyack (Pippin).—Of medium to large size and attractive appearance; oblong inclining to conical; yellow with red blush; crisp, tender, juicy, with pleasant sub-acid flavor; quality good. September and October.

Paw Paw.—A medium-sized apple of good quality and apparently a long keeper; yellow overlaid and striped with light red; roundish, oblong; firm, juicy, sub-acid. November to May.

Pewaukee.—Of large size and attractive appearance; yellow, striped, splashed and shaded with light and dark red and covered with light bloom; quality fair; firm, fine grained, dry; flavor mild. A promising market variety. December to March.

Rainbow.—Of medium size; roundish-conical; yellow overlaid with light and dark red; flavor mild, indistinct; rather dry, fine grained; quality low. Last of August.

Reynard.—A very large yellow apple of fair quality; form oblong; flavor mild sub-acid; texture coarse, breaking, rather dry. Season October and November.

Sabadkai.—Medium to large size; yellow with faint tinge of red at the base; oblate; tender, crisp, fine grained with mild sub-acid flavor.

Scotts (Winter).—Size medium, oblate; color yellow overlaid with stripes and splashes of light and dark red; firm, crisp, juicy, with brisk sub-acid flavor; quality good.

Summer Red.—Of medium size, roundish-oblate; color yellow overlaid with dark reddish-brown cheek; flavor mild almost sweet; texture firm; quality fair. Season September.

Thompson (10).—A medium-sized apple of fine appearance; roundish to oblate; yellow with light and dark red splashes and stripes; firm, moderately juicy; flavor sub-acid; quality good. Season September.

Thompson (38).—Large, roundish-oblate; greenish-yellow, striped and splashed with red; firm, crisp, juicy; quality fair. Ripe last of August. Promises to be productive and may be valuable for home use or market.

White.—A very large white apple of attractive appearance, but of low quality; tender, dry, mealy, sub-acid. Season last of August.

Yellow Bellflower.—An old well-known variety once quite largely planted, but being replaced by other varieties at present. Of medium size, oblong, irregular; color yellow with occasionally a bright red cheek; tender, juicy, crisp, with high sub-acid flavor. A good keeper, and excellent for culinary and dessert purposes, but comes into bearing late. Season December to March.

NOTES ON OLDER VARIETIES.

Antonovka.—A very large yellow apple of Russian origin. Oblate conical, with brisk sub-acid flavor; as yet unproductive. Season last of August and early September.

Arnold.—Large, yellowish-white, of good quality. Too light in color and tender in texture to prove valuable for market, but an excellent variety for home use. Trees thrifty and productive. Season November to March.

Bailey.—A very large, showy, red winter apple of sweet, pleasant flavor. Trees fairly vigorous and productive. One of the best sweet varieties.

Battullen.—Fruit below medium in size, but smooth and attractive; quality good. Tree vigorous, but as yet has not proved to be productive.

Ben Davis.—An old well-known variety that has been largely planted, but is being replaced by other varieties in Michigan, on account of poor quality. A long-keeper. Trees hardy, vigorous and productive.

Bietigheimer.—One of the most attractive apples in appearance, but of low quality. Trees fairly vigorous but unproductive.

Borovinka.—Of Russian origin. Trees hardy, vigorous and productive. Resembles Oldenburg in both tree and fruit. Season last of August. A valuable market variety.

Bottle Greening.—Tree vigorous, fairly productive. Fruit large and of good quality; rather tender for market, but a fine dessert fruit. Season November to February.

Buckingham.—Of large size; color greenish yellow, shaded with light and dark red; quality fair. November to March.

Canada Baldwin.—Size medium; color yellow, striped and splashed with rich light and dark red; quality good. Tree vigorous, but has proven to be unproductive so far. Season December to April.

Carlough.—Above medium in size and of good quality, but too light in color to make a good market variety. If productive, will be valuable for home use as a long keeper. Season December to April.

Chenango.—Tree vigorous and productive. Fruit of large size, oblong conical; color yellow, striped and splashed with red; quality best. Valuable for home use and near-by markets. Season last of August.

Colton.—An early and abundant bearer. Size medium; color greenish-yellow. Valuable for home use as an early-ripening variety. Last of July.

Cornell.—Of medium size; color yellow, shaded and striped with light red; tender, fine-grained, with mild sub-acid flavor; quality good. Tree lacks vigor and productiveness as yet. Ripe early September.

Cullin.—Size medium to large, of good quality and a long keeper. Rather too light in color for a good market sort. Tree not vigorous, but fairly productive.

Duchess Seedling.—Large, smooth, attractive, of fair quality. Somewhat resembles Oldenburg in tree and fruit; ripens a few days earlier. Promising.

Early Joe.—Below medium in size; of excellent quality. Good for home use. Late August and September.

Fameuse.—An old, well-known variety, and at one time very popular. Of the finest quality, and valuable for the garden collection. Ripened fruit for the first this season, on twelve-year-old trees.

Fanny.—Of medium size and attractive appearance; color dark, rich red; quality best. Promising for both home and market.

Flushing (Spitzenburg).—A medium-sized dark, rich red winter apple, of good quality. Tree fairly vigorous, but late in coming into bearing. Season November to March.

Garden Royal.—Of the finest quality, but valuable for home planting only.

Gideon.—Tree hardy, vigorous and very productive; size medium to large; color yellow, with pale red cheek; very handsome; flavor brisk sub-acid. Valuable for home use, or market where an early fall apple is desirable.

Grimes (Golden).—Tree vigorous and productive. Fruit smooth, medium-sized, yellow, of excellent quality. Valuable for home use or market.

Haas.—Size medium to large; color yellow, red-striped; quality fair to good. Has no distinctive qualities to make it valuable here. Season October and November.

Hagenkopt.—Large, roundish, conical; color yellow, striped with light red; quality low. Not valuable. September.

Hubbardston.—Of large size and attractive appearance; quality very good. Tree fairly vigorous and an abundant bearer. Valuable for home or market. Season November to February.

Iowa Keeper.—A firm-fleshed, long-keeping variety; below medium in size; quality fair. Too small to be of value as a market sort. Trees vigorous and productive. Season December to June.

Jefferis.—Tree fairly vigorous, very productive. Fruit small to medium; color yellow, striped with dark, rich red; quality best. Valuable for home use. September.

Jersey Sweet.—A very prolific early sweet apple; quality good; color yellow, striped with red.

Jonathan.—One of the most popular apples known for home use and market. Has been and is at present largely planted for commercial purposes. Size small to medium; color yellow, shaded with mottled dark, rich red; quality very best. Season November to March.

Keswick.—One of the hardiest and most productive varieties grown. Valuable for home use as an early-ripening sort for culinary purposes. Ripens over long season.

Kinnaird.—A dark red winter apple of attractive appearance, large size and good quality. Tree vigorous in growth but as yet not very productive. Requires further trial.

Limber Twig.—Of small size and of only fair quality. Not promising.

Longfield.—Tree fairly vigorous and very prolific. Size medium; quality good. Season September and October.

Louise.—A seedling of Snow, but not so attractive in appearance as that variety; flavor and quality much the same, but the trees come into bearing much earlier than that variety. November to January.

Lowell.—An old, well-known variety commonly known as Greasy Pippin. Tree vigorous and very productive. Fruit of large size and good quality. Valuable for home use.

Magog.—An attractive yellow, striped apple of fair to good quality. Slow to bear. Not promising.

Mason (Orange).—Size medium to large; yellow, with red cheek; of excellent quality. Rather tender for market but valuable for home use. Season November to February.

McIntosh.—A medium-sized, dark red apple of good quality. Tree vigorous and productive. October to January.

Milwaukee.—Size large, roundish-oblate; color yellow, striped red; texture crisp, tender, with brisk acid flavor. Tree vigorous and promises to be productive. Ripe middle of September.

Minkler.—An apple that can be safely recommended for commercial planting. Medium size; color greenish-yellow, overlaid and striped with red; of good quality; firm fleshed, and a long keeper. Tree vigorous and productive. January to April.

Morris Red.—Of large size, attractive appearance and excellent quality. Valuable if it proves productive. November to March.

Munson.—Size small to medium; of rich yellow color; smooth, with sweet, pleasant flavor. A good dessert apple. September.

Oakland.—A medium-sized, dark red, winter apple of good quality. Quite largely planted for commercial purposes. Tree a slow, spreading grower, moderately productive. November to March.

Oldenburg (Duchess).—The most popular variety for late summer and early fall market. This season it brought the highest price of any apple in station collection. It needs no recommendation.

Ontario.—A cross between Northern Spy and Wagener, and one of the most promising of the newer winter varieties. It combines the early

and abundant bearing qualities of Wagener with the large size and vigorous growth of the Spy. Of good quality and attractive appearance. Valuable.

Peter.—A seedling of Wealthy and practically identical with that variety. September and October.

Ramsdell.—A showy, red, sweet apple of fair quality. November to February.

Red Canada.—An old, well-known variety, once largely planted for market, but is now being replaced by other varieties. Fruit large, dark red, of fine quality; attractive in appearance and a long keeper. November to April. Trees lack vigor and are late in coming into bearing.

Red June.—A medium-sized, dark red apple, attractive in appearance and of very good quality. A popular early market sort as grown South for Northern markets. Tree vigorous and very productive.

Ronk.—Size medium to large; color yellow, clouded with dull red; quality good. Tree upright, spreading, rather slow in coming into bearing.

Rosenhager.—A Russian apple of large size; brownish red in color, but of poor quality. Tree vigorous and productive. October to December.

Roxbury (Russet).—Of large size and very good quality. Considered valuable for home and market. Season December to June. Tree vigorous, but late in coming into bearing.

Scarlet Cranberry.—Of medium size, fair quality. Tree vigorous, moderately productive. December to April.

Shannon.—A large, smooth apple of greenish-yellow color; quality good. One of the newer varieties that may prove valuable. December to March.

Sheriff.—Small to medium in size; color bright red when fully matured; texture crisp, tender, juicy, with mild sub-acid flavor; quality very good. Tree moderately vigorous, very productive. November to March.

Shiawassee (Beauty).—Similar to Snow in flavor and quality, but is larger and superior to that variety. October to January.

Stark.—Of large size; color yellow, shaded and striped with dull red; quality good. Tree vigorous and very productive. A valuable variety for home or market. December to May.

St. Lawrence.—A large, red-striped, attractive fall apple; quality good. Planted to some extent for market, but not so desirable as other varieties ripening at that season. September and October.

Stuart.—Of small size; color yellow, with red cheek; quality good. Not desirable.

Summer Lievland.—Of medium size; yellow, striped red; of fair quality. Not desirable.

Summer Rose.—A handsome dessert apple, ripening in August; color greenish-white, shaded with bright red. Valuable for home planting.

Thompson (29).—A large, greenish-yellow apple of fair quality. Will require further trial.

Titovka.—Of Russian origin, and one of the most productive varieties on station grounds. Fruit large and handsomely colored; ripens a few days before Oldenburg. Tree a poor grower. Valuable for home or market.

Walker.—Medium to large; greenish-yellow, splashed and washed with red; firm-fleshed and a long keeper. December to April.

Washington Strawberry.—Of large size and good quality; color yellow, striped and splashed with red. Tree fairly vigorous and productive. Of value as a market sort. September.

Wealthy.—Tree moderately vigorous and an early and abundant bearer. Fruit large and handsomely colored. A valuable fall market variety. Follows closely after Oldenburg, and is a valuable sort to plant with that variety.

Whinery.—Is a comparatively new variety that as yet has proved unproductive. The fruit is of medium size, attractive in appearance and a long keeper. December to April.

Yellow Transparent.—Of Russian origin, and one of the most valuable varieties grown for home use and nearby markets. Of medium size; pale yellow in color; tender, juicy, sub-acid. Last of July and early August.

CRAB-APPLES.

NOTES ON VARIETIES.

The following points were noted in regard to harvesting and marketing crab-apples. In harvesting, the fruit must be picked while firm and crisp. If an attempt is made to hold the fruit over, it invariably gets dry and mealy and the market quotes all such down. There is very little demand in the city markets for varieties that ripen in August, except Whitney and others that are used largely for dessert purposes. The demand begins at the end of the first week of September and continues until well into October. Hyslop was quoted at the top of the market the whole season through.

August.—Size very large for a crab-apple; color yellow, washed and striped with red; crisp, tender; quality fair. August. Not considered valuable.

Dartmouth.—Of medium size; dark, rich red; quality very good; resembles Hyslop somewhat, but is not equal to that variety.

Florence.—The tree is an upright, spreading grower, moderately vigorous and very productive. Fruit small, inclined to overbear; color clear yellow, striped with light red; quality good. Late August and early September.

Excelsior.—Size large; handsomely colored; of good quality and very productive. Rather tender, but excellent for home use or near-by markets.

Gibb.—Of medium size; pale yellow; poor in quality. Not valuable.

Jelly.—Tree vigorous, but as yet only moderately productive; color yellow, overlaid with bright red; size small; quality good. Considered of some value for culinary purposes.

Martha.—A medium-sized, handsomely colored apple of excellent quality; gave the most satisfactory results of any variety on trial this season. Valuable. Early September.

North Star.—Inclined to run small; of only fair quality, and not attractive enough in appearance to be valuable.

No. 1 New.—Said to be a crab seedling, but classed with apples on the

market. Very large, of attractive appearance and excellent quality for culinary purposes. Very tender and requires careful handling.

No. 2 New.—Like No. 1 New, this variety resembles the apple rather than the crab. Tree not so vigorous but more productive. Of smaller size and not so attractive in appearance. Not desirable.

Quaker.—A late-ripening variety of only fair quality. Size medium to large; color yellow, with red cheek. Tree handsome, vigorous, but not very productive. October.

Whitney.—Medium to large; color yellow, shaded with light and dark red, and has a sprightly sub-acid flavor; quality very good. Used to some extent for dessert purposes. Tree vigorous and productive. Valuable.

QUINCES.

NOTES ON VARIETIES.

Alaska.—Smaller than Orange, but otherwise not very different from that variety.

Orange.—Medium to large; greenish-yellow; firm, crisp, of good quality. An early and an abundant bearer.

Meech.—Below medium in size; slightly pear-shaped; greenish-yellow. Season very late.

Missouri.—Of largest size and best quality, but only moderately productive. One of the earliest to ripen.

Rea (Mam).—The most profitable variety in the list. Very large, vigorous and productive. A seedling of the Orange, but larger and finer quinces than that variety.

Van Deman.—Medium to large. Seems to differ little from Orange.

NUTS.

Four varieties of chestnuts fruited this season. Cosford and Kentish Cob filberts bore a partial crop and the Japan walnut trees again bore a full crop. The English walnut is apparently of no value here, lacking in vigor and hardiness. A number of varieties that had been grafted on different stocks were received this spring from the Division of Pomology. In this way we may be able to get some variety that will be vigorous and hardy enough to be of some value in this climate.

CHESTNUTS.

EUROPEAN VARIETIES.

Comfort.—Tree a strong, vigorous grower. Nuts of large size; rich dark brown color, and excellent quality, but as yet lacks productiveness.

Numbo.—Tree a poor, slow grower here; moderately productive. Nuts medium to large size; quality good. Not valuable here.

Paragon.—This variety is by far the best variety on trial. Tree vigorous and an early and abundant bearer. Nuts of large size and excellent quality. Worthy of a place on every farm and home grounds where

the climate is suitable. In the eastern part of Michigan the native chestnut grows on deep, sandy, gravelly soils and usually on ridges.

JAPAN VARIETIES.

The trees of this group are dwarfish in habit and slow growers. Nuts are from medium to large in size, but are inferior in quality to the European varieties and are borne in much thinner burrs. Of the five varieties of this group on trial, Hale, Superb, Japan Giant, Japan Improved and Reliance, the last named was the only one which fruited this season. It promises to be the most productive variety of this group. Bore a full crop this season from tree planted in 1899. Tree a slow grower but this may be due somewhat to its productiveness. The nuts are of medium size, good quality and borne in very thin burrs.

FILBERTS.

Cosford (Thin Shell).—A thin-shelled variety of fine quality. Hardy and quite productive. Valuable for home use and ornamental purposes.

Kentish Cob.—This variety is more vigorous than Cosford, but as yet not quite so reliable. The nuts are much larger and of good quality.

WALNUTS.

Japan Walnuts (*Juglans Seiboldii*).—Trees hardy, vigorous and productive. The nuts are borne in large clusters and are a little smaller in size than the English walnut, which they resemble in shape. Quality fair and in flavor something like our native butternut.

COVER CROP EXPERIMENT.

Eleven plots (of a quarter of an acre each) were sown with different kinds of cover crops—cow peas, broadcast; cow peas in drills twenty inches apart; sand vetch; Canada peas; Crimson clover; Mammoth clover, oats, buckwheat, rape and flat turnips, broadcast. One end of all but one of the plots was sown to oats with the original sowing, barley being used on this plot in the place of oats. The plots were sown the 10th of August. At the beginning of winter the following points were noted: As a cover crop, the cow pea is almost a failure except where the oats were sown with it. It made a fine growth and was no doubt valuable in adding nitrogen to the soil. Drilling is to be preferred to broadcasting in this case. As a cover crop, oats seem to be ideal this season, with barley, buckwheat and sand vetch following closely, and on all the plots where oats were used with them their value as a cover crop was improved. No difference is noticeable at this time between Crimson and Mammoth clover. While the clover has not made as good a showing as a cover crop as some of the other plants, observations in the spring at the time of plowing may show it to be of more value. It is conceded by all that clover is the most valuable crop that can be sown in the orchard, where the conditions are favorable for it, as it is much more reliable on sandy soils than on clay.

NOTES ON SMALL FRUITS.

BY M. L. DEAN.

STRAWBERRIES.

Bulletin No. 206.

The season of 1902 was unfavorable for the growing of strawberries of the best quality. Late frosts in some localities ruined the earlier berries and more or less impaired the quality of the general crop. The extremely wet weather retarded the development of pollen and many blossoms were not properly fertilized, causing many green-tipped, poorly formed, knotty berries. There was a tendency, however, for the berries to be of extra size, but they were rather soft and lacked in flavor. This in a measure affected the scoring of the varieties and improved the rating of some, while others rated low in color, texture and flavor. The varieties having imperfect blossoms showed the most serious lack in fertilization.

NOTES ON THE NEWER VARIETIES.

Auto.—Received from Slaymaker & Son, Dover, Del. The flowers are perfect. The vines are very vigorous and hardy; foliage small but dense. There seems to be a tendency to throw an excess of runners, and they should be kept well pruned to encourage fruit development. The plants are very productive and developed a large percentage of imperfect, irregular berries. Late frosts and cold, wet weather might have caused much of this trouble. The berries are uniformly large, round, conical, bright crimson; flesh pink, pleasant and desirable in quality. For vigor and productiveness the variety seems to be of much promise. The uniformity of berries through the season is a striking peculiarity. The berries ripened two days later than Haverland.

Belle of La Crosse.—Received from John A. Salzer, La Crosse, Wis. Flowers perfect; foliage medium size, dense, dark, glossy green; fruit stems are very numerous, stout and upright. The berries are of medium size, broad, round conic, regular, bright crimson, and thickly covered with seed, which makes them very attractive. The pulp is firm, reddish, rather acid, but pleasing.

A very productive sort and promises to be of some value as an early market variety.

Cameron's Early.—Received from D. Brandt, Bremen, Ohio. Flowers perfect. The vines are extremely strong growers, and have long, stout, upright leaf stems; leaves large, coarse, dense, light green, and show a tendency to rust.

The fruit was lacking, in proportion to the growth of vines. Frost hurt them badly, so it is hard to judge as to productiveness without further trial. They blossom full, but the fruit stems are lacking in berries. They are stout and upright; berries usually round, regular, conic, some slightly elongated and a little irregular; color, bright crimson; tex-

ture, firm; flavor, rather acid. Its extreme earliness makes it very promising for an extra-early variety.

Commander, from the same grower, has perfect blossoms.

The vines seem to lack in hardiness, but are vigorous, strong growers; foliage large, broad, dark green. The runners are not numerous, but sufficient for the growth of the plants; fruit stalks short, stout, few but well filled; berries are of good size, a little irregular, round, broad conic; seeds are deeply set, numerous. The pulp is firm, dark crimson, reddish clear through; flavor pleasant acid. An attractive berry of promise for fancy purposes. Season medium.

Corsican.—Received from Green's Nursery Co., Rochester, N. Y. Flowers perfect. The vines are very vigorous, but seem to lack in hardiness. The foliage is large, broad, dense and of a dark, glossy green; runners scattering; fruit stems numerous, but they are not well filled. The berries were very large, round conical, and of a dark crimson color; flavor very pleasant; texture a little soft for market purposes. If, on further trial, the variety develops more fruit, the quality and appearance will make it a very desirable, fancy, medium early berry.

Crines Double Cropper.—Received from John Lewis Childs, Floral Park, New York. Flowers perfect. The vines are very hardy, vigorous and over productive. The foliage is small and has short, low-growing stems; runners superfluous; fruit stems numerous and over-loaded with small, dark scarlet berries. The shape of the fruit is regular conic, slightly flattened at the tip; pulp, pink, juicy but rather acid. The variety has the same tendency of over-productiveness as the Parker Earle and would be a good variety for hill culture when it can be given extra care and fertilizers. The season is medium.

Double Cropper from Brandt has perfect blossoms. The vines in vigor and hardiness are all that is desired. The foliage is large, dense, dark green; leaf stems long and stout; runners numerous. There seems to be an abundance of fruit stalks and they are well filled; berries are dark, bright scarlet, thickly seeded on the surface; form elongated conic; pulp firm, with a sharp, acid flavor. It has not developed any habits that the name would signify, but it is a hardy productive variety of some promise. Seems to be identical with Crines Double Cropper, from Childs. There was only one day difference in the season.

Duffs.—Received from J. G. Harrison and Sons, Berlin, Md. Flowers imperfect. In hardiness and vigor, this variety stands well. The foliage is dark green, large, and has stout, low-growing stems; runners numerous; fruit stems abundant and well loaded with small, conic, firm, bright scarlet berries of acid flavor. This variety came from North Carolina and is inferior in quality to many other early sorts.

Everbearer.—Received from Jno. A. Salzer, La Crosse, Wis. Flowers perfect. The plants are hardy, but lack vigor. The foliage is small, sparse and spindling; runners not numerous; fruit stems abundant, and well filled, but the berries are small; color, dark scarlet, round regular conic and thickly seeded. The flavor is pleasant and further trial may show improvements in some weak points. Season early to late.

Giant (Wisconsin).—Received from John A. Salzer, La Crosse, Wis. Flowers perfect. This is a very promising, medium variety, for large fancy berries. The vines are hardy and vigorous; foliage healthy, medium size, dense and of a dark, glossy green color. The runners are numerous but not over abundant; fruit stems of good number and well

filled. The berries are large, bright red, broad, regular, round conical in shape; pulp is light colored and firm for so large berries; flavor, pleasant, sharp and sprightly.

Hawaii.—Received from Flansburg and Peirson, Leslie, Mich. Flowers perfect; vines very vigorous and perfectly hardy; foliage of medium size, dense, bright green in color; runners numerous. The fruit stems are lacking in number, and are long, slender and fairly well filled with bright scarlet, elongated, slightly necked, rather irregular round berries. The pulp is a little soft, bright pink. The parentage is Haverland fertilized with Parker Earle and the combination should produce a valuable berry. Medium early.

Hero, from the above parties, has a perfect blossom. The plants are hardy but are not as strong growers as some varieties. The leaves are broad and thick; stems stout, stiff and have red markings, some being entirely red; runners are about medium in number. The fruit stems were not numerous and they lack in quantity of fruit, but the frost was partially the cause. The berries are medium to large, broad, conical, regular, bright red, thickly seeded and have a pink pulp of good texture and pleasant flavor. If they prove to be more productive they will be a valuable variety for fancy fruit of high quality, for early trade.

Howard No. 2.—Received from G. W. Howard, Stevensville, Mich. Flowers imperfect. The plants seem to be very strong growers, but winter-killed some. The leaves are large, dense and dark green; runners few; fruit stalks scattering; berries large, round, regular conic, bright crimson, juicy, a little soft. The flavor is mild and pleasant, but not especially striking. The fruit is very attractive, but unless the plants prove to be better bearers they will be of no value for general purposes. Season medium.

Jersey Market.—Received from J. G. Harrison and Sons, Berlin, Md. Flowers imperfect. Very hardy and of good vigor. The foliage is coarse and has large, tall stems; runners are numerous. The fruit stalks are numerous and well filled with medium to large, dark crimson berries, the pulp of which is firm, juicy, and has a delightful flavor. Owing to its productiveness, size, quality and strength of plants, it seems to be a promising medium late variety.

Late Mastodon.—Received from Jno. A. Salzer, La Crosse, Wis. Flowers imperfect. The berries which ripened were very attractive, medium to large, bright crimson, regular, round conic and have a very sharp pleasant flavor. The vines are hardy, vigorous and healthy, and have a dull dark green color. They made a remarkable growth of runners and fruit stems, but many of the blossoms failed to develop fruit, either from the effect of frost, wet weather or weakness of pollen. Season late.

Leo and Marie are two varieties received from Flansburg and Peirson. The vines of Leo are rank growers, hardy and have large, broad, rather light colored foliage, but showed a tendency to blight. The runners were numerous; fruit stems large but lacked berries. The berries were light colored, coarse and rather irregular; flavor mild and sweet; pulp soft. Further trial may develop more favorable points. Flowers perfect. Season medium to late.

Marie has imperfect flowers, and is a very attractive, desirable mid-season sort. It seems to lack a little in hardiness but is quite vigorous. The vines have small, dense, dark-colored foliage and but few runners; fruit stems are not very numerous, slender, but well loaded. The berries

are round, uniform, regular conic, dark crimson and thickly covered with bright golden seed; pulp firm, crimson and of excellent flavor.

Manokin.—From Slaymaker & Son. A medium to large, attractive berry. The plants seem to be vigorous and productive, throwing a preponderance of runners and stems; but the stems are long and well loaded. The berries are regular in form, conic, bright crimson, firm, juicy and have a pleasant sparkling acid flavor, and range from medium to large in size. The flowers are imperfect. The fruit ripened about a week later than Haverland.

Monitor.—Received from R. M. Kellogg, Three Rivers, Mich. Perfect flowers. The vines are satisfactory in vigor and hardiness, and have small, dense, light-green foliage. The berries are of a bright scarlet color; large, broad, round, little conic; pulp deep red, firm and has a sharp pleasant flavor. The fruit stems are numerous and heavily loaded, while the runners are sufficient to make it a good variety for propagating. It seems to have many promising characteristics for a late variety.

Perfection.—From Salzer. A hardy, vigorous grower but it lacks in productiveness. The runners are scattering and the berries are small, conical, uniform and regular. The flavor is a decided acid. In color and appearance they are attractive, being firm and of dark crimson color to the core; flowers perfect. Of no special promise. Medium to late.

Ponderosa.—Another variety from Salzer. Has perfect flowers. It is a strong grower, but lacks in hardiness. The foliage is tall, dense, medium sized and has a dark, dull green, healthy color. It has an abundance of fruit stems and runners. The berries are medium to dark crimson in color, glossy, juicy and have an excellent flavor. The productiveness and quality makes it very promising as an early variety.

Porto Rico.—An imperfect flowered variety received from Flansburg & Peirson. It is very hardy and vigorous, and throws a large number of runners. The foliage is small, dense, low-growing and of a light green color; fruit stems short, stout and well filled. The berries are elongated, somewhat flattened, dark crimson, thickly seeded, and lacking in flavor. The pulp is red and rather soft. It is supposed to be a cross between Haverland and Parker Earle. The habit is similar to Parker Earle, but it is not as productive. Season medium to late.

Rip Snorter.—Received from W. Rapp, Terre Haute, Ind. Has perfect flowers, dense, dark green, glossy foliage, which usually indicates plants of strong vigor. The fruit stems are numerous and well filled, but many of the blossoms were blasted, showing that they were susceptible to injury from frost. The berries that matured were large, round, broad, light-colored and of good flavor, but a little soft. If all the blossoms set and the berries matured it would be a very productive variety but they seem to be easily killed by frost. The season was medium to late.

Simons Early.—Flowers perfect. Received from Slaymaker & Son. The plants lack in hardiness, but seem to be of good vigor. The runners and fruit stems are numerous. The berries are attractive and of good flavor but the pulp is a little soft for an early market berry.

Table Queen.—Received from D. Brandt, Bremen, Ohio. Has perfect flowers. The plants appear to be weak, spindling growers and throw too many runners and fruit stems. The berries are small to medium in size, nearly round, light colored, and have a rather insipid flavor. Further trial may develop more favorable characteristics. The season is medium.

Uncle Jim.—Also called Dornan, after J. F. Dornan of Glenn, Mich.,

the originator. The flowers are perfect. The plants are vigorous, but they winter-killed slightly. The foliage is dense, of a dark, glossy green, healthy color. The berries are somewhat elongated, almost necked, large, bright scarlet. They have a firm pulp and pleasant flavor, but lack a little in juice. The runners and fruit stems are numerous, showing productiveness in both plant and fruit. Season medium.

Uncle Sam.—Received from D. Brandt, Bremen, Ohio. Has a perfect blossom. The berries ripen about the same season as the Bubach. The vines are thrifty and hardy, productive of plants and fruit. The berries are broad, medium to large, round, a little flattened, light colored, have a pleasant flavor, but the pulp is a little soft. The season was one day later than Uncle Jim. It is a seedling originated in Ohio and owing to vigor of plants and productiveness it warrants further trial.

11-59 P. M.—Was sent out by the Hale Nursery Co., South Glastonbury, Conn., and was afterward named Midnight by Mr. Hale. The flowers are perfect. The plants seemed vigorous but lacked in hardiness, many being winter-killed. In fruit stems and berries it ranks high, but it appeared to be a poor plant grower, the runners being scarce. The berries are large, rough, necked, light colored and of medium quality. It is a very late variety, and it may prove to be of some value by further trial on that account.

VARIETIES REPORTED ON LAST YEAR.

Bennett.—As reported, last year, the plants lack in productiveness. The berries are small but of good flavor for an early sort.

Bobolink did not develop any traits that warrant giving the variety further trial. It might have a place among strictly fancy berries where extra care could be given. Season, early-medium.

Bryan lacks in hardiness and productiveness. Season, medium.

Bush Cluster has a strong growing plant and is a good pollenizer, but the berries are too light colored to rank among the popular mid-season varieties.

Carmi Beauty is an early to medium berry of promise. The quality is good and in productiveness and vigor of plant it has few superiors.

Carrie Silvers failed to develop any promising characteristics. The berries are of good quality, but the plants are poor growers. Medium.

Crockett.—The berries are not up to the standard in quality. It is a great plant grower but not promising for fruit of the best flavor. Mid-season.

Dole holds up in quality very nicely. The fruits are attractive and of good quality for early berries.

Downing's Bride is a promising mid-season variety. Color of berries, dark crimson; quality, excellent. The plants are vigorous and strong growers. This was also placed on the market under the name of Kittie Rice.

Dunlap proved to be low in productiveness and the berries were too rough to warrant special recommendation. Medium to late.

Empress and Emperor seem to be good berries for late fruiting. Under special care they are of good size, very attractive and of fine quality.

George's Triumph.—The berries are too small and rough to be attractive for the market, although it is a very productive, medium late sort.

Gibson resembles Marshall in fruit, but lacks in growth of plants. It ripened five days later than Marshall.

Gladstone improved as the plants reached two years growth and it would have a place among the extra early desirable varieties, if the berries were smoother and darker colored.

Joe is not particularly promising. Season medium to late.

Kansas.—The berries are too small to warrant general culture, owing to there being so many other mid-season varieties of merit.

Klondike seems to hold up as an extra late variety. The fruit is dark colored, regular in shape and of medium quality. The plants are strong growers.

Lady Jane.—The berries are light colored and small.

Livingston seems to warrant a place among the canning varieties. It is productive and the berries are of good color. Mid-season.

McKinley has a large, attractive berry, and still holds its place as a desirable medium late berry although it was very soft this season.

Mexican should be given hill culture, as it is a strong feeder. The fruit is large and of excellent quality. Early to medium.

Mrs. McDowell did not prove to be as good as last season. The berries were very soft and of poor flavor, rough and irregular.

Nettie improved in productiveness, but the berries were too soft to be valuable for shipping. Season, medium to late.

New York did much better than in previous years, but is still far behind what is claimed for it by some growers. It is worthy of trial on good soil for an early medium variety.

Parson's Beauty.—The berries are somewhat irregular, which mars the attractiveness of an otherwise good, early medium berry. In growth of plant they are desirable. Nearly identical with Pocomoke.

Pennell.—The growth of plant is hardly sufficient to warrant its becoming a standard variety for the mid-season trade.

Pocomoke.—The berries were large and of good flavor, but many of them were fan-shaped. It is a very productive variety and of the Wilson type. Medium to late.

Reba seemed to be very tender and succumbed to the winter. Medium to late.

Repeater.—The berries were much larger than the first crop, but in a dry season the plants could not carry the crop to maturity. Season, early medium.

Robbie is too light in color to be popular for Michigan markets. Season, late.

Rough Rider claims a place among the desirable varieties. It is not a heavy bearer, but the fruit is of good quality, attractive, and maintains its size through the season. A late variety.

Seaford has some good points, but none that would place it above many other late varieties.

Seedling No. 1 is perhaps worthy of a name for a home berry. The berries are dark colored and have a pleasant flavor, but are a little soft. The season is about medium.

Shepherd did not seem to rank as well as in 1901. The berries are light colored and lacking in quality. Season, quite late.

Stella.—The berries were very rough and irregular. The season is very late.

Stone 130 develops some traits of merit. Medium to late.

Sunshine falls short of what it was advertised to be. The berries are irregular and rough. It ranks as a medium late variety.

Twilight throws too many fruit stems for the strength of the plant. It seems to be rather early.

Up-to-Date.—As reported last year, this variety has no special value. It is of the old Sharpless type but not equal to it in value. Early medium.

1901 was of too poor quality to warrant further trial. Its season is medium.

SUMMARY OF STANDARD VARIETIES.

Beder Wood is one of the most popular, medium-early berries grown. The berries are always large and of good quality. The plants are thrifty and productive, but somewhat subject to rust.

Brandywine.—The quality of the fruit, vigor and productiveness of plant makes this a standard among medium-late, fancy berries.

Bubach is a variety that is largely grown, because it will thrive under ordinary conditions. The berries are attractive in shape and color, of good size, and the plants are productive.

Excelsior and Michels Early are two extra early varieties. Excelsior is, in some respects, superior to Michels.

Gandy holds its place among the standard late sorts. While it lacks a little in quantity of berries, the size and quality meets the deficiency. It thrives on any good soil.

Haverland.—This is an all around general purpose berry that properly remunerates for any extra care given.

Marshall is a very attractive berry of high quality, but the plants seem to lack in vigor and are susceptible to rust unless sprayed with Bordeaux mixture.

Rough Rider, Parsons Beauty and several other sorts seem to be forging to the front for a place among the standard sorts. Many other varieties in the tests previously published in our bulletins have desirable features and with some growers are pronounced superior to the above, but space will not permit the description of all good varieties, hence only such are selected as are likely to give the best satisfaction with the largest number of growers for general purposes.

RASPBERRIES.

From the lack of a desirable location the experimental varieties have been reduced until the list includes only a few of the better sorts. In the spring of 1901 a new plantation was set which will be reported as they come to fruiting maturity.

BLACK VARIETIES.

Coloma produced a small amount of fruit for the first time. The canes are of fair growth. The berries are jet black, medium size, and of good quality. Further trial is necessary to determine its real value. It is a mid-season, thornless variety received from John Wenslick, Coloma, Michigan.

Cumberland is one of the most desirable varieties of recent introduction. It is very productive. The canes are strong, vigorous and healthy, and seem to be very hardy. The fruit is a bright black in color, of good size

and has a sweet pleasant flavor. They average about eleven to the ounce in weight. The first fruit ripened July 2 and the last July 30, holding their size and quality well through the entire season.

Eureka is a desirable early sort. Ripened June 20. The canes are thrifty and healthy. In productiveness they rank well. The berries are medium to large, round, a little conic, pulpy and have a pleasant flavor. Averaged 16 to the ounce.

Gregg is the most popular black cap grown and adapts itself to almost any conditions. With good culture there are few superior. The canes are strong, productive, but not quite hardy; berries attractive and of choice quality. 12 to the ounce.

Kansas is a very productive variety largely grown for commercial purposes. The berries are of good quality and of medium size. Averaged 16 to the ounce. Ripened June 28 to July 26.

Lotta seems to be very susceptible to the rust and anthracnose. The berries are of good quality but the canes lack vigor.

Ohio.—The canes are rather weak and spindling in growth but bear heavily. The berries are rather small, bright black, round, pulpy and of pleasant flavor. The period of ripening was June 29 to July 20. Averaged 30 to the ounce.

Pride of Ohio.—It is not as productive as some of the other varieties, but the berries are of a solid black color, firm and desirable. The canes are hardy, strong growers. Fruiting period, July 6 to 24. Averaged 20 to the ounce.

Livingston produced medium sized berries of fair quality. The canes are strong growers and productive.

Palmer.—The berries average too small to be popular, ranking 29 to the ounce. The canes are spindling but seem healthy.

PURPLE.

Shaffer is the best known variety of this class. The canes are thrifty and productive. Berries loose and of medium quality.

Columbian is of better color, firmer, and the canes are less injured by anthracnose.

RED VARIETIES.

Eaton, received from Amos Garretson, Pendleton, Indiana. The canes are hardy, strong growers; fruit, dark red, oval, medium size and has a tendency to rattle some. The quality is not up to the Loudon or Cuthbert.

Harris.—The fruit is of poor quality, and the canes have a short, stocky habit. The berries are of medium size, bright red, coarse, and crumble badly. The flavor is flat and insipid.

Loudon ranks as one of the standard red varieties. The canes are usually thrifty, and productive of berries of choice quality. This and the Cuthbert are two of the best red varieties.

Ridgeway was received from M. H. Ridgeway, Wabash, Indiana. The canes are very strong and thrifty growers but the berries are few in number and small. The flavor and texture is good.

Gold, a yellow variety, was received from the same party. The canes are good growers and the berries are good for their class, but there is no place on the market for them, the popular demand being for black or red berries.

Muskberry, a novelty sent out by John Lewis Childs of Floral Park, N.

Y., fruited for the first time this year. The canes are extremely rank growers, reaching 8 to 10 feet in height. They spread very badly from the roots, and, like the strawberry-raspberry, are a decided nuisance in a garden. The fruit is of good size and attractive in appearance but the flavor is insipid and disagreeable. The bushes throw off a musky odor.

BLACKBERRIES.

The soil and location here is such that it is impossible to grow blackberries with any degree of success.

Rathbun, Mersereau, Hess and other improved varieties have been tried several times, but they winter-kill every year.

Early Harvest seems to thrive as well as any variety and is very productive, in years when the plants do not winter-kill. The berries are large, thick and have a very small core. The flavor is pleasant.

Snyder and Taylor are two standard varieties that usually produce fruit of good quality in any section where blackberries are grown. While hardy and productive, the fruit is rather small.

CURRENTS.

In 1897 and 1898 several of the newer varieties of currants were planted and have reached maturity from a fruiting standpoint.

Eclipse, received from H. S. Anderson, Elizabeth, N. J., has strong, vigorous healthy bushes. The stalks are upright, stout and thickly covered with large leaves. The fruit stems are long and well filled, containing 12-16 rather small dark red fruits which have a sprightly, heavy, rich juice. The berries are rather small for fancy use, but the quality is fine for jellies and they are very productive.

Empire, received from J. Lewis Childs, Floral Park, N. Y., seems to lack in hardiness, as the bushes winter-kill and do not recuperate readily. The berries are large, of a bright, dark or ruby red, but the stems are short and contain only a few berries. The berries are of good quality and attractive, but the plants are not productive enough to be profitable.

Filler, received from Jos. H. Black & Son, Hightstown, N. J. Originated in Ulster Co., N. Y. The bushes are very coarse, upright growers, with dark rank foliage. The clusters are of medium size, long, well filled with bright red currants. They are of good size, attractive and have a pleasant, rich flavor.

London Market, received from Alexander Hamilton, Bangor, Mich., is a promising variety for general cultivation. The berries are a little larger than those of Pomona, and have a bright, clear, red color. The juice is thick, heavy, and of a pleasant, sprightly flavor. The bushes are thrifty and vigorous but not quite as productive as Pomona.

Pomona, received from Albertson & Hobbs, Bridgeport, Ind. This has proved to be one of the best varieties of recent introduction. It is a vigorous, thrifty grower and exceedingly productive. The clusters are long, and are filled with medium-sized berries, of a mild, rich, pleasant flavor. The color of the fruit is a bright, clear, red, becoming dark when

fully ripened. They adhere firmly to the stems which prevents their massing in the boxes.

Purity, received from John Lewis Childs, Floral Park, N. Y. The bushes are low-growing and have a sprawling habit. The fruit is a yellowish white, but it is not equal to the White Transparent in quality or productiveness.

Red Cross, from Green's Nursery Co., Rochester, N. Y., is another choice variety. The bushes are more upright and coarser than Pomona, but not quite so productive. The berries are a little darker in color and a trifle larger than the Pomona, and the stems are long and loosely filled. The quality is excellent.

Scarlet Gem is not what the name would signify, being a pinkish white currant. The bushes are low growers, coarse, and sparsely covered with foliage; stems long, fairly well filled with small sub-acid, pleasant flavored berries.

White Transparent, received from Geo. S. Josselyn, Fredonia, N. Y., and White Versailles from John Charlton & Sons, Rochester, N. Y., are two choice white sorts resembling each other. The berries are about the same size, and have a rich, thick juice of a desirable sprightly flavor. The bushes are upright, strong growers, and well loaded with fruit. The Transparent bunches are not quite as long as the Versailles, but are a little more compact, which make the productiveness about the same. The Versailles berries are a trifle larger, but in general they are two choice varieties of white currants.

Wilder,—received from Isaac Rogers, Dansville, N. Y., is a seedling of the Versailles. The berries are a little larger than Fay's Prolific and are of superior quality. The bushes are thrifty and productive. It is a valuable variety.

GOOSEBERRIES.

In 1902, both the American and English varieties gave a good crop of fruit. The season was very wet and by spraying the English varieties with Bordeaux mixture early in the season, and following later with frequent sprayings of liver of sulphur (1 ounce to 3 gallons of water), the mildew was held in check so that the fruit was not severely injured.

Of the American varieties, Downing, with green colored berries, is one of the best known varieties. They are hardy, of good quality and very productive. Some of the newer varieties are larger but inferior in quality, and can only be grown with the utmost care and attention. This is especially true of the English sorts.

Pearl and Red Jacket are the two best of the newer sorts of the American varieties. They are thrifty, productive and of good quality.

Among the English varieties we have Chautauqua, Columbus, Industry, Keepsake and Lancashire. They have made medium to good growth, but it is only by careful handling and weekly spraying that we can mature the fruit. It is large, of choice quality, and attractive, but except for home use and when a grower has immediate access to some good market, they are not desirable.

A new plantation was put out in 1901 which includes the best of the newer varieties, and reports will be made on their behavior as they develop.

Agricultural College. February 2. 1903.

SUGAR BEET EXPERIMENTS, 1902.

C. D. SMITH, DIRECTOR.

Bulletin No. 207.

The work with sugar beets in 1902 was largely in continuation of the experiments reported in Bulletins 150, 179, 188 and 197. The amount of land available for beets on the college farm is not large and had been nearly all used prior to 1902, hence, it was found necessary to carry on part of the experiments at points some distance away and on land over which complete control could not be exercised. The season was unusually wet and -cold, necessitating re-seeding in some cases and utterly ruining the crop in others. The investigations carried on during the year were as follows:

- A. Distribution of beet seed through the Upper Peninsula and an analysis of samples of beets grown there.
- B. Compilation of the analyses made in 1902, and former years, of beets grown in all counties of Michigan.
- C. Variety tests.
- D. Spraying to prevent disease.
- E. Distance apart of rows.
- F. Exhaustion of the soil by beets.
- G. Production of beet seed.

A. Sugar Beets in the Upper Peninsula.

The details of this investigation are reported in Special Bulletin 18. Sugar beet seed either donated by the Chemical Division of the National Department of Agriculture or purchased from the Lansing Sugar Company, of Lansing, Michigan, was distributed among a large number of farmers selected by Supt. L. M. Geismar, in thirteen of the counties of the Upper Peninsula. The soils varied from a sandy loam to a heavy clay. The seed was sown in late May. The plots were cultivated almost entirely by hand and were too small to allow computation of yields per acre. Samples of beets for analysis were received at the college from 153 plots. The sample beets were sent through the mails enclosed in cloth sacks, and were, therefore, somewhat shriveled on arrival. The chemist, Mr. F. W. Robison, studied the loss of water by the beets shipped long distances and found the shrinkage in weight of the beets to vary from 16% to over 21% although at the time he made the tests, it was impracticable to simulate the conditions obtaining in the mail bag in transit. Such a shrinkage in weight of beets means that the per cents of sugar actually in the beets when pulled were much less than indicated by the polariscope at the college. Unfortunately no constant factor can be suggested whereby this source of error may be eliminated. The fact of this error must be kept in mind when considering the following table which records the average per cent of sugar and purity found in the samples of beets from the thirteen counties named:

NUMBER OF SAMPLES, PER CENT OF SUGAR IN BEETS AND PURITY OF BEETS GROWN
IN THIRTEEN COUNTIES OF UPPER PENINSULA.

Counties.	No. of samples.	Ave. per cent of sugar in beet.	Average purity.
Alger	5	13.4	82.
Baraga	18	15.9	82.8
Chippewa	37	15.3	83.9
Delta	35	15.7	81.75
Dickinson	2	14.1	81.2
Houghton	7	17.4	84.21
Iron	2	15.	86.4
Luce	1	17.11	92.
Mackinac	8	16.55	84.57
Marquette	10	13.85	80.67
Menominee	17	16.6	86.3
Ontonagon	5	15.0	87.64
Schoolcraft	6	15.16	84.7

The factor used in reducing the sugar in juice to sugar in beet was .92. The purity of the beets was low and they were seldom fully ripe. A consideration of the table lends color to the belief that the Upper Peninsula can produce beets very rich in sugar. One possible reason for this fact is that during the growing season, the higher the latitude the more hours the sun is above the horizon. In latitude 47 degrees, for instance, the sun is above the horizon, for any given point, 69.13 hours longer than in latitude 42, in the six months between April 15th and October 15th. The storing of sugar by the leaves is dependent on light, either the direct rays of the sun or sunlight diffused through clouds. These northern latitudes, therefore, have a marked advantage in the excess of sunlight during the growing months.

B. Compilation of Records of Analyses of Beets.

Each autumn since 1897, inclusive, it has been customary for the chemist of the station to analyze samples of beets sent in for the purpose. The results of these analyses have never been published. They are submitted here to properly conclude the work of the Station in this phase of the sugar beet investigation.

These are given in the following table. Opposite the name of each county are the number of samples sent in from that county, the average per cent of sugar in the beet and the average purity.

County.	No. of samples.	1897.		No. of samples.	1898.		No. of samples.	1899.		No. of samples.	1900.		No. of samples.	1901.		No. of samples.	1902.	
		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.
Alcona.....				1	16.6-69													
Alger.....	1	13.00-80														5	13.6-82	
Allegan.....	3	14.40-86					5	14.50-83								1	14.9-88	
Alpena.....	2	13.80-80																
Antrim.....	2	14.60-82					1	18.40-89								1	17.9-84	
Arenac.....	8	15.50-88		2	13.9-86		1	14.00-83										
Baraga.....	1	12.10-76														18	15.9-83	
Barry.....	4	13.80-81					12	12.10-79										
Bay.....	10	14.20-84		4	13.7-80		4	15.20-83										
Berrien.....	3	16.30-87					7	12.50-80										
Branch.....	3	15.20-84		1	15.4-83													
Calhoun.....	6	14.50-84																
Cass.....	2	14.10-82					5	12.10-76										
Charlevoix.....	7	16.10-87																
Chippewa.....				1	16.0-83		1	12.80-76								37	15.3-84	
Clare.....	1	15.40-84																
Clinton.....	4	14.60-84		1	14.7-88													
Crawford.....	1	13.40-81																
Delta.....							1	10.90-75								37	15.7-82	
Dickinson.....																2	14.1-81	
Eaton.....	5	16.10-83		2	13.6-83		8	11.90-77										
Emmet.....	1	13.80-82		1	15.0-82													
Genesee.....	6	13.50-82		1	17.1-86		25	13.60-73										
Grand Traverse.....	7	14.40-82		1	19.4-91													
Grafton.....	6	14.80-88		2	15.7-89		26	18.20-80										
Hillsdale.....	2	15.30-84					4	12.70-79										
Houghton.....																7	17.3-84	
Huron.....	6	16.00-86		1	15.4-83		21	14.50-82		2	14.3-83							
Ingham.....	36	15.00-87		15	12.6-79		8	12.90-79					6	11.6-80		3	16.7-88	
Ionia.....	4	14.90-82																
Iosco.....	6	12.10-77					6	14.30-88										
Iron.....	1	16.70-80														2	15.0-86	
Isabella.....	4	12.90-78		1	13.7-87		4	11.70-79										
Jackson.....	7	8.97-74		1	15.2-86		10	13.60-80										
Kalamazoo.....	16	14.10-82		10	12.2-82		5	12.80-80										
Kalkaska.....	2	15.50-83											1	16.2-89		1	18.4-90	
Kent.....	16	14.20-83		1	14.1-85		23	14.40-80										
Lake.....							3	12.50-79		1	15.4-86							
Lapeer.....	2	16.30-84																
Leelanau.....	3	17.20-89																
Lenawee.....	5	14.60-85		2	13.8-88													
Liveston.....	2	13.10-80					1	12.90-80										
Luce.....																1	17.1-82	
Mackinac.....	1	14.80-85														2	16.5-84	
Macomb.....	11	14.70-82					69	12.40-78										
Manistee.....	6	16.40-84		2	14.8-85													
Marquette.....	5	15.10-85					8	14.11-80								10	13.2-81	
Mcosta.....	4	15.30-84		1	15.0-86		3	12.10-79										
Menominee.....	6	15.20-84		1	16.5-83		6	13.60-83								13	16.5-88	
Midland.....	2	16.2-86		1	14.7-85													
Missaukee.....	1	14.60-84																
Monroe.....	2	15.00-84		4	11.6-79		3	13.80-80										
Montcalm.....	2	16.0-83																
Montenap.....	9	14.70-85					2	14.50-86		2	15.8-89							
Newaygo.....	13	14.80-81		1	14.5-82		1	14.50-83										

County.	No. of samples.	1897.		No. of samples.	1898.		No. of samples.	1899.		No. of samples.	1900.		No. of samples.	1901.		No. of samples.	1902.	
		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.		Per cent sugar in beet.	Purity.
Oakland.....	7	14.0-83		4	12.9-81		5	14.6-80										
Oceana.....	11	15.1-86		1	14.3-83		1	16.1-85										
Ogemaw.....				1	16.3-88													
Ontonagon.....	4	13.9-79														5	15.0-86	
Osceola.....	3	15.1-85					4	15.0-83										
Oscoda.....				2	16.5-83		3	14.4-85										
Otsego.....	1	16.6-90		1	15.0-91		1	15.9-81										
Ottawa.....	15	15.0-83		2	14.9-87		9	13.2-83										
Saginaw.....	127	14.7-84					2	13.1-83		9	13.2-83							
Sanilac.....	11	16.6-86					1	14.5-86					3	13.3-82				
Schoolcraft.....				1	14.6-88		1	16.2-83								7	15.1-86	
Shiawassee.....	4	15.5-83		1	17.1-88		5	13.9-81										
St. Clair.....	31	16.1-83					5	13.6-80										
St. Joseph.....	1	11.1-76		2	13.9-80		3	13.1-81										
Tuscola.....	1	17.4-89		2	16.6-88		8	14.5-92										
Van Buren.....	4	12.6-80					1	13.5-81								1	16.2-84	
Washtenaw.....	4	14.8-84		1	15.9-82		2	14.0-84										
Wayne.....	9	14.8-84		2	12.0-80		30	12.4-79										
Wexford.....	9	13.3-79																

In co-operation with a host of intelligent farmers the station has been able to demonstrate that the growing of beets rich in sugar is entirely practicable in all parts of Michigan from Houghton to Monroe and from Alpena to Benton Harbor. While the per cents of sugar have varied with the seasons, they have almost invariably been high enough to warrant the use of the beets in the factory. In fact, the average richness of Michigan beets is higher than that of beets grown in Ohio and Indiana, though lower than in Colorado and some other western states.

A further study of the table brings out some facts tending to confirm the general statement that beets grow richer in sugar the farther north they are grown. If the counties are grouped in tiers across the State from east to west and the reports are compiled to show the number of samples and the average per cent of sugar in the beets in each tier, going from the south north, we have the following table:

Berrien, Cass, St. Jo, Branch, Hillsdale, Lenawee, Monroe.....	49	12.6
Van Buren, Kalamazoo, Calhoun, Jackson, Washtenaw, Wayne.....	116	12.1
Allegan, Barry, Eaton, Ingham, Livingston, Oakland, Macomb.....	207	12.2
Ottawa, Kent, Ionia, Clinton, Shiawassee, Genesee, Lapeer, St. Clair.....	159	14.5
Muskegon, Montcalm, Gratiot, Saginaw, Tuscola, Sanilac.....	213	14.5
Oceana, Newaygo, Mecosta, Isabella, Midland, Bay, Huron.....	96	14.5
Mason, Lake, Osceola, Clare, Gladwin, Arenac.....	19	15.1
Manistee, Wexford, Missaukee, Roscommon, Ogemaw, Iosca.....	31	14.1
Benzie, Grand Traverse, Kalkaska, Crawford, Oscoda.....	19	15.4
Leelanau, Antrim, Otsego, Montmorency, Alpena, Alcona.....	11	15.9
Menominee, Charlevoix, Emmett, Cheboygan, Presque Isle.....	25	15.5
Chippewa, Mackinac, Luce, Schoolcraft, Alger, Delta, Dickinson, Marquette, Iron, Baraga, Ontonagon, Houghton.....	126	15.4

With irregularity and with conspicuous exceptions, there is a general increase in the sugar content of the beets as we work northward.

C. Variety Tests.

The question of varieties is an important one to the factory and to the grower. The former furnishes the seed and is, therefore, the party first interested. Heretofore, the station has accepted for trial, beet seed from

the agents of the foreign producer. In 1902 this plan was abandoned. Each factory donated to the station ten pounds of seed of each variety it used. The seed was tested for germination and vitality, divided into three parts and grown in three different locations on different kinds of soil and under different climatic conditions.

At the college the varieties were sown in tenth acre plots on a level area of dark loam. Wood ashes were applied at the rate of half a ton per acre. The plots were 8 rods long by 2 rods wide. The rows were 18 inches apart. The seed was sown May 3 and May 5. The spring was wet and ground sticky and hardly fit to work when the seed was sown. On the 8th of May and again on the 15th a Breed's weeder was run over the field crosswise the rows and cultivation with hand cultivators began May 20th. The beets were "blocked" May 26th and cultivated again between May 28th and June 1st.

Thinning began June 4th and ended June 11th. The beets were thereafter cultivated frequently enough to keep the surface stirred and loose. The beets were hoed a second time August 1st.

The harvesting occurred October 12-15. The beets lay in piles covered with leaves until October 23d when they were weighed and again sampled. The per cents of sugar given are averages of duplicate samples.

At Alma the beets were planted on the farm of Mr. Fred Church. The soil was a heavy clay loam. The planting was greatly delayed by continuous rainfall and was not completed until May 30th.

Through the wet season the cultivation was kept up as well as the condition of the soil would allow. Harvesting began October 21st, but was not completed for several weeks on account of rain. The beets were delivered and weighed at irregular intervals up to December 16th, although the samples for analysis at the college were taken October 24th. In the table below, therefore, the sugar in the beets as found at the college is given and the sugar found in them by the factory on delivery is also given. The yields of sugar per acre are estimated using the per cents of sugar found at the factory.

The third field devoted to variety tests was on the farm of A. F. Goodnoe, west of Lansing. The soil was a deep black, alluvial, loose, rich prairie-like soil. The seed was planted on May 15, the soil being in ideal condition. The cultivation, thinning and care of the crop was well attended to but the very wet season caused the beets to be flooded and drowned out in spots to such an extent that all calculations of yield were out of the question. Samples were secured for analysis, however, and the table below will show that notwithstanding the fact that the constant flooding made the beets globular in form, the per cent of sugar on these plots was actually much higher than on those at the college or at Alma.

The following factories generously donated seed for this test:

The Bay City Sugar Company.
The Michigan Sugar Company.
The Lansing Sugar Company.
The Holland Sugar Company.
The Marine City Sugar Company.
The German-American Sugar Company.
The Alma Sugar Company.
The West Bay City Sugar Company.

The Valley Sugar Company.

The varieties, on account of the length of their names will be referred to by the numbers given them in the following table:

LIST OF VARIETIES.

1. Seed from Schreiber und Sohn, Nordhausen, Germany.
2. Seed from Meyer und Raapke.
3. Original Kleinwanzleben, Rabbetge und Geisecke.
4. Hoerning's Improved Kleinwanzleben.
5. Hoerning's Improved Kleinwanzleben.
6. Sachs' Kleinwanzleben.
7. Zuckerreichste Kleinwanzleben.
8. Verbesserte Kleinwanzleben.
9. Original Kleinwanzleben, Rabbetge und Geisecke.
10. Pioneer Kleinwanzleben, Rabbetge und Geisecke.
11. Sachs' Kleinwanzleben.
12. Hoerning's Elite Kleinwanzleben.
13. Hoerning's Elite Kleinwanzleben.
14. Hoerning's Elite Kleinwanzleben.
15. Sachs' Kleinwanzleben.
16. Original Kleinwanzleben, Rabbetge und Geisecke.
17. Hoerning's Improved.
18. Zieman's Improved.
19. Verbesserte Kleinwanzleben, seed of 1901.
20. Verbesserte Kleinwanzleben, old seed.
21. Dippe's Kleinwanzleben.
22. Rabbetge und Geisecke.
23. Jaensch Victrix.
24. Knauer's Mangold.
25. Jaensch Victrix.
26. Hoerning's Improved.
27. Hoerning's Improved.
28. Mette's Improved
29. Jaensch Victrix.
30. Seed from Schreiber und Sohn.
31. Meyer's Frederichswerth Elite.
32. Hoerning's Elite.
33. Jules Legras.

The next table reports the results of germination tests, conducted by Mr. Bronson Barlow:

GERMINATION TESTS—100 FRUITS TAKEN IN EACH CASE.

Variety.	Sprouts in 7 days.	Sprouts in 14 days.	Total Sprouts in 14 days.
1. Schreiber	77	46	123
11. Sachs.	99	26	125
22. Rabbetge & G.	121	35	156

Variety.	Sprouts in 7 days.	Sprouts in 14 days.	Total Sprouts in 14 days.
32. Hoerning	104	35	139
15. Sachs'	117	14	131
13. Hoernings	69	45	114
2. Meyer & Raapke	132	31	163
5. Hoerning	113	14	127
3. Kleinwanzleben	160	29	189
14. Hoerning	136	37	173
6. Sachs	130	23	153
30. Schreiber	135	21	156
29. Jaensch	202	15	217
12. Hoerning	149	16	165
9. Kleinwanzleben	200	9	209
10. Kleinwanzleben	141	21	162
21. Kleinwanzleben	155	23	178
24. Knauer	109	17	126
20. Verbesserte	64	45	109
19. Verbesserte	113	25	138
23. Jaensch	228	6	234
27. Hoerning	112	26	138
31. Meyers	225	6	231
18. Zieman	137	20	157

The next table records the sugar in the juices of the several varieties. At the college October 7, duplicate samples separately reported; at the college October 23; at Alma October 24; on the Goodnoe farm October 28.

Note that in this table the per cent of sugar in the juice and not in the beet is reported.

VARIETY TESTS—SUGAR AND PURITY.

Number.	College, October 7.		College, October 7.		College, October 23.		Alma, October 24.		Goodnoe farm, October 28.	
	Sugar %	Purity.	Sugar %	Purity.	Sugar %	Purity.	Sugar %	Purity.	Sugar %	Purity.
1.....	16.6	91.2	16.2	93	17.4	91.6	14	77	18	85.3
2.....	15.8	92	15.6	93	16.5	86	15.7	82.2	17.1	85.1
3.....	15.5	94	16.1	91	.....	.....	13	87.8	18.7	92.1
4.....	14.5	93	16.8	91.3	15.4	89	15.3	85.5	16.4	90.6
5.....	16.6	96	15.2	89.4	14.6	86.9	16.8	94	16	87.9
6.....	16	88.9	15.8	89.8	17.8	92	15.3	80	16.7	86.1
7.....	15	84.7	17.3	94	18.9	94	15.2	82.2	18.5	92
8.....	15.7	81	15.1	95	14.6	89	14.2	78	17	91
9.....	15.5	90.7	15.8	93	15.6	90.2	15.7	84.9	18.7	94
10.....	15.5	87.1	16	91	16.9	89.5	9	47	16.6	88.3
11.....	16.4	94	16.2	96	.....	.....	15.3	81.8	16.3	81.4
12.....	15.7	97	14.3	87.8	14.9	89.3	15	84.3	17.7	83
13.....	15.9	94	15.5	89.6	14.8	88.1	14.6	82.9	16.3	82.8
14.....	15	89.8	15.3	91	15.5	85.2	14.8	84.6	16.6	91
15.....	15.3	93	14.5	89.5	14.3	84.6	15.2	81	15.7	89.2
16.....	15.2	89.4	15.4	89.8	17.1	91	16	86.5	17.3	91
17.....	15	90	15.8	93	17.1	93	15.3	88.1	17	87.2
18.....	16.5	86	15.5	87.1	18.4	96	15.2	88.4	17	90.1
19.....	14.4	86.7	15.8	95	15	90.4	14.5	81.9	17.4	84.9
20.....	15	89.3	14.5	87.9	15.7	89.2	16.8	93	15.5	87.6
21.....	.....	.....	17	96	16.4	93	15	77	17	88.5
22.....	15.7	92	16.8	97	16.8	91	14.2	77	17.3	86.1
23.....	15.3	90	15.5	93	16.4	89.6	16.4	85.9	15.9	87.9
24.....	15.5	96	14.6	89.6	16.5	84.7	15.5	88.1	15.9	87.9
25.....	.....	.....	.....	.....	.....	.....	14.8	79	17.7	96
26.....	.....	.....	.....	.....	.....	.....	16.8	91	16.5	88.7
27.....	.....	.....	.....	.....	.....	.....	14	79	15.8	83.2
28.....	.....	.....	.....	.....	.....	.....	14.4	76	.....	.....
29.....	.....	.....	.....	.....	.....	.....	14.8	79	.....	.....
30.....	.....	.....	.....	.....	.....	.....	13.1	71	17.5	82
31.....	.....	.....	.....	.....	.....	.....	15.8	82.7	15.4	88.5
32.....	.....	.....	.....	.....	.....	.....	16	76	17	82
33.....	.....	.....	.....	.....	.....	.....	.....	.....	15.5	85.2

The fact that two adjacent beets in the same row, grown from the same seed, in the same soil and under identical conditions may vary in per cent of sugar from one to even two per cent, renders the interpretation of a table like the above a very difficult task. The value of a variety is measured by the amount of sugar it yields per acre. In our experiments, this amount is measured by multiplying the net weight of beets yielded per acre by the per cent of sugar in the beet. The per cent of sugar in the beet is supposed to be correctly determined when three or four beets are tested. As a matter of fact the individual beets in a given plot may and do vary as widely from each other in this regard as do samples from separate plots.

Note as bearing on this statement, the behavior of variety 5, samples of October 7, taken the same day from the same plot, care being used to secure beets similar in size and shape. Variety 18 displays a similar perversity, as do varieties 22, 19 and 12, while 7 shows a variation of over two per cent in sugar between samples selected from the same day. Unfortunately the beet does not have conspicuous external signs

whereby the experimenter can tell whether it fairly represents the plot wherein it grows or not. The introduction of this element of chance in securing representative samples seriously injures the value of tables in which varieties are compared and all tables as well where yields of sugar per acre are contrasted. In practical work at the factory also the inability to secure samples known to fairly represent the load throws doubt upon the whole system of paying for beets according to the sugar they are supposed to contain.

Omitting varieties 3, 11, and 21 which were not reported from all tests, and taking the averages of the remainder of the twenty-four varieties grown at the college, at Alma and on the Goodnoe farm, we find that the duplicate samples taken at the college on October 7 gave an average test of 15.5 and 15.6 or practically identical and this notwithstanding the fact that individual samples of the same variety varied so widely as we have just seen; on October 23 the per cent of sugar in these varieties had increased from 15.5 to 16.2; the records at Alma, as determined by analysis at the college, were but 15.3 per cent, more than a per cent less than the same varieties grown at the college; on the Goodnoe farm, on the other hand, the average per cent of sugar in these same varieties was 16.8, higher than either at the college or at Alma.

These findings are interesting especially when it is remembered that the Goodnoe soil was almost a muck and lay so low that it was flooded with water for the entire season except in spots large enough to furnish samples for analysis, and on these spots the water was so close to the surface that the beets were round and turnip-shaped rather than conical.

The principal factor in determining the per cent of sugar in the crop of beets is the variety chosen. The beet is an exceedingly highly-bred plant, selected and bred for many generations to secure the greatest possible amount of sugar in the roots. No matter how well cared for the crop may be, if the seed is not from selected stocks, the crop will be low in sugar. The farmer cannot materially alter the per cent of sugar in the crop by any methods of culture if he puts the crop on any soil other than undigested muck or does not use too nitrogenous fertilizers. The farmer must depend upon the factory to furnish him the seed that will grow beets rich in sugar, knowing that he cannot affect the beets materially in this respect.

Further work will be needed to determine whether there is a material difference in varieties as to their adaptation to different soils and conditions. The season was too wet this year to make the above table of great value as far as it bears on this question.

The yields of the several varieties are reported in the next table. As stated there were no yields computed from the Goodnoe plots.

D. Spraying to Prevent Disease.

In co-operation with the Department of Agriculture at Washington, a series of experiments were undertaken to determine the practicability of spraying with Bordeaux mixture to prevent leaf blight and possibly other diseases of beets. The too frequent rains ruined the experiments and there are no results to report. Leaf blight was very prevalent and undoubtedly lessened the yield of all plots reported in this Bulletin. It was noted that the disease was much less severe where beets did not follow beets and also where the ground had been well fertilized with ashes, the strong vigorous plants possibly being better able to resist.

VARIETY TESTS—YIELDS.

Variety.	College—Yield per acre.			Alma—Yield per acre.		
	Beets, pounds.	Sugar, per cent.	Sugar, pounds.	Beets, pounds.	Sugar, per cent.	Sugar, pounds.
10 R. & G., Pioneer.....	25,700	15.5	3,984	26,787	13.8	3,697
6 Sachs.....	26,110	16.3	4,256	26,367	14.2	3,744
11 Sachs.....	28,380	14.9	4,229	26,172	13.0	3,402
15 Sachs.....	24,800	13.1	3,249	26,608	13.7	3,645
13 Hoerning.....	25,090	13.6	3,412	24,781	13.1	3,246
4 Hoerning.....	27,830	14.2	3,952	25,172	12.6	3,172
14 Hoerning.....	25,820	14.2	3,666	24,718	15.4	3,807
17 Hoerning Imp.....	26,570	15.7	4,171	26,224	12.6	3,304
12 Hoerning Elite.....	25,960	13.7	3,537	26,500	13.0	3,450
5 Hoerning.....	25,780	13.4	3,455	26,114	13.0	3,394
26 Hoerning Imp.....				26,546	13.0	3,446
27 Hoerning.....				24,034	13.8	3,317
9 R. & G. Original.....	28,250	14.3	4,040	21,109	13.8	2,918
3 R. & G. Original.....	24,370	14.2	3,631	25,816	14.5	3,743
16 R. & G. Original.....	23,580	14.9	3,702	30,299	14.4	2,923
22 R. & G. Original.....	22,800	15.4	3,511	23,270	14.8	3,443
20 Verbesserte Klein.....	31,290	13.4	4,192	23,149	13.8	3,196
8 Verbesserte Klein.....	30,230	13.8	4,172	23,505	13.8	3,244
21 Verbesserte Klein.....	30,010	14.4	4,321	22,859	13.2	3,017
31 Schreiber.....	23,340	16.3	4,130	25,586	14.2	3,633
30 Schreiber.....				24,051	15.4	3,804
24 Knauer's Mangold.....	20,330	15.1	3,070	23,890	12.9	3,082
23 Jaensch Vixtrix.....	18,830	15.0	2,824	22,867	14.3	3,199
25 Jaensch Vixtrix.....				20,781	13.6	2,826
28 Mette's Imp.....				24,247	13.3	3,273
21 Dippe.....	25,340	15.0	3,801	23,942	14.6	3,496
7 Zuckerreichste.....	26,180	16.4	4,294	22,660	14.2	3,217
2 M & Raapke.....	26,930	15.2	4,093	23,386	13.6	3,180
31 Fr. derichs werth.....				25,002	13.9	3,476
18 Zieman's Imp.....	25,300	17.0	4,301	23,390	13.1	3,064

E. Distance Apart of Rows.

To continue the tests as to the influence of the distance apart of rows on the total yield of beets per acre and their quality, fifteen plots were set aside in field No. 6 of the College farm. The soil was a gravelly loam, to which was added wood ashes at the rate of two tons to the acre. There was also applied, May 20, 175 pounds nitrate of soda and 475 pounds of mixed fertilizer per acre. The beets were sown May 22 and 23. Three varieties were used, Dippe's Kleinwanzleben, Virmorin's Very Rich and Strandes' Kleinwanzleben.

The beets were cultivated frequently and thinned prior to June 26. They were harvested between October 11 and October 15.

The following table gives the data as to yields:

YIELD AND PER CENTS OF SUGAR IN BEETS PLANTED AT VARIOUS DISTANCES.

Distance.	Plot.	Beets per acre, less 12 per cent tare, pounds.	Per cent sugar in beets.	Variety.
16 inches.....	1	14,202	16.1	Dippe's Kleinwanzleben. Vilmorin's Very Rich. Strandes Kleinwanzleben.
16 inches.....	6	19,329	15.1	
16 inches.....	11	16,368	17.0	
Average.....		16,633	16.0	
18 inches.....	2	15,644	16.56	Dippe. Vilmorin. Strandes.
18 inches.....	7	17,908	16.0	
18 inches.....	12	15,490	15.4	
Average.....		16,354	15.98	
20 inches.....	3	16,167	16.0	Dippe. Vilmorin. Strandes.
20 inches.....	8	17,077	13.3	
20 inches.....	13	15,972	16.0	
Average.....		16,406	15.1	
22 inches.....	4	16,104	15.5	Dippe. Vilmorin. Strandes.
22 inches.....	9	16,940	14.1	
22 inches.....	14	15,654	16.0	
Average.....		16,232	15.2	
24 inches.....	5	15,745	16.1	Dippe. Vilmorin. Strandes.
24 inches.....	10	16,224	16.4	
24 inches.....	15	15,246	15.6	
Average.....		15,788	16.0	

Neither in yield of beets nor in per cent of sugar do the averages for the several distances, 16, 18, 20 and 22 inches vary greatly. Two feet appears to be too far apart for greatest yield of beets per acre although there seems no decrease in the per cent of sugar. There is evidently no relation between the width of rows and the richness of the beets.

In Bulletin 197, page 122, there is a summary of the work with the width of rows, the distances there taken being 18, 21 and 24 inches and the general conclusion being that "Considering the entire work involved in the narrowing space between rows together with the inconvenience and even impossibility of cultivating with large farm horses in narrow rows, it seems as yet fully as wise to continue with the rows twenty-one inches apart at least." The experiments this year point in the same direction.

In Europe, where human labor is relatively cheap, it is customary to plant beets in rows approximately sixteen inches apart. Russian experiments (Deut. Landw. Presse, 26—1899—page 289) indicate as the minimum of best distances sixteen inches apart of rows and approximately nine inches apart in the row.

The association of Danish sugar manufacturers carried on experiments, 60 trials with results indicating the superiority of even a closer planting, 14 inches rather than 18. (Ugerke Landm. 40, pp. 119-121.)

In this country where the work is to be done largely by horses and where the land is seldom as well fertilized as in Europe, the distance between rows may well be maintained at 20 to 22 inches and certainly not less than 18. The importance of the less labor per ton of beets in the wider row must not be forgotten.

F.—Exhaustion of the soil by beets.

To test the influence of cropping a soil of light sandy loam with beets for three successive years, a strip 80 feet wide running north and south through a field sixteen rods wide from north to south, was planted to beets for three years in succession.

East and west of this strip were other plots parallel to it that for the same three years produced crops of clover, oats, millet or alfalfa. These plots were not all of the same width.

The whole area had been planted to *Lathyrus silvestris* in 1890 and had borne that crop, without plowing, until 1898. This legume had stored the ground with humus through the decay of its roots. After 1898 the history of the several plots, beginning at the west is shown in the following table, which also gives the widths of the plots, the length in each case being sixteen rods:

Plot.	Width, feet.	1899.	1900.	1901.
1.....	16.5	Bromus inermis.....	Bromus inermis.....	Bromus inermis.....
2.....	32	L. Silvestris.....	L. Silvestris.....	Millet.....
3.....	80	Beets.....	Beets.....	Beets.....
4.....	18.5	Beets.....	Beets.....	Oats.....
5.....	24	Fallow.....	Clover.....	Alfalfa.....
6.....	12.5	Clover.....	Fallow.....	Fallow.....
7.....	86	Clover.....	Fallow.....	Clover.....

Three crops were used in 1902 to test the influence of the beets as against the crops on either side of the beet strip. The north 72 feet of all the plots just described was sown to oats, the next strip across these plots, just south of the oats was planted to beets and the third strip, reaching to the southern limits of the plots was planted to corn. The width of the beet strip was 79 feet and the corn 114. This test is but one of a series, and the table below, reporting the yield per acre of oats, beets and corn on the several areas is given as a report of progress only.

The sudden drop in yields on plots 3 and 4 with all three crops is significant. Both plots had had beets for two years, plot three for three years and plot four for two years, followed by one year of oats.

YIELDS PER ACRE OF OATS, BEETS AND CORN.

Plot.	Oats.		Beets.		Corn.	
	Grain, pounds.	Straw, pounds.	Pounds.	Per cent sugar.	Ears, pounds.	Stalks, pounds.
1.....	1,259	2,814	13,437	14.3	.....	.....
2.....	1,213	2,769	18,534	12.5	4,783	4,348
3.....	929	2,612	8,965	14.0	922	2,636
4.....	825	2,575	8,989	16.0	1,630	3,696
5.....	891	3,519	10,581	15.5	2,800	2,692
6.....	1,040	3,460	12,454	14.3	3,550	5,500
7.....	1,028	3,782	14,153	15.9	4,008	4,054

It is also to be stated that these beet plots had been used in fertilizer experiments, and on the average as much mineral matter had been added to the soil as the crops had removed. In most cases also, more nitrogen had been added than the crops had required. No barnyard manure had been carted on the field and there must have been a very decided decline in the humus content of the soil. Comment on the table is not needed. It teaches its own lesson.

G.—Production of beet seed.

The preliminary work directed toward the production of seed of value to beet growers was begun in co-operation with the Department of Agriculture. The seed was sent on from Washington in the spring and was sown on the farm of M. D. Pickett, south of Okemos. The beets grew well notwithstanding the bad season and the mother beets were pulled and pitted in the fall. Next spring these mother beets will be tested and all those showing a high enough per cent of sugar will be set out to produce seed. Naturally no report can be made this year.

MICHIGAN MUSHROOMS.

A FEW OF THE COMMON EDIBLE FUNGI OCCURRING IN THE STATE.

BY B. O. LONGYEAR.

Bulletin No. 208.

The abundance and variety of fleshy fungi found growing in dooryards, fields and woods at certain seasons of the year have doubtless attracted the attention of many persons in this State. These plants are especially numerous during the spring and autumn months and whenever there is a plentiful rainfall during the summer. However, they are usually passed by and left for the "worms" or scattered with a kick. Thus a free offering frequently near our very door-step may be neglected or spurned while the same product is being imported from foreign lands and sold for a high price in the markets. Naturally the question arises why pay fifty cents to one dollar a pound for mushrooms from France or for hot house grown material when a generous supply of the same, or of equally desirable species, is going to waste about us?

There are many persons in our State who would be glad to eat our native mushrooms were it not for fear of poisoning. That this fear is well founded is shown by the fact that many cases of severe illness and even loss of life are annually recorded through carelessness in the indiscriminate eating of fungi.

Moreover the prevailing ignorance and superstition regarding these plants have added to the uncertainty which seemed to attend their use as food. And while this fear has often served a useful purpose in restraining many persons from carelessness in the eating of mushrooms, it has also prevented them from making use of a highly esteemed natural food product, obtainable often without expense other than the effort necessary to gather it.

It is stated that in Germany the school children are regularly trained in the matter of distinguishing the edible and poisonous species of fungi so that they can readily identify them even when mixed together. Certainly there seems no good reason why the intelligence of the average American should not enable him to learn to recognize a number of the common edible mushrooms with which everyone who has access to woods and fields is sure to meet.

Moreover many of the fleshy fungi can be as easily and surely recognized as our common flowering plants. Were this more generally understood and the fear from poisoning thereby removed the use of edible fungi as food would certainly increase.



Figure 1. The Common Morel (*Morchella esculenta*).—(Original.)

SOME POPULAR ERRORS ABOUT MUSHROOMS.

Much of the uncertainty which to many persons seems to attend the collecting of the edible fungi is fostered by the many popular errors concerning the true nature of these plants and the means by which they may be identified. These mistaken notions, which often amount to superstition, are largely due to the fact that a large part of the development of these plants is hidden from view. Consequently their ways are shrouded in mystery to the average observer. Then, too, their sudden appearance coupled with the fact that they often grow in dark, damp places where most other plants do not thrive, lends to them an unnatural, strange or uncanny aspect which may often prove a fertile source of suggestion to the superstitious mind.

Thus it seems to be no uncommon belief that in some mysterious way toads have something to do with them, hence the term toadstool, which suggests to the imaginative mind the picture of a toad squatting on top of one of these plants. It is to be very much doubted if any person ever saw a toad in such an unusual and uncomfortable position. Moreover many of them are incapable of supporting the weight of even the smallest toad, while others often grow where no toad has ever been. In fact there is no more foundation for such a belief than there would be for an idea that toads cause the growth of other plants near which they may happen to be found.

One very common error in the use of these terms is that a mushroom and a toadstool are two distinct things, hence the oft repeated query, "How do you tell a mushroom from a toadstool?" To the surprise of the inquirer the answer of the botanist is that there is no difference. This leaves the matter in greater doubt than before. The person who is able to recognize one fungus as edible usually applies to it the term mushroom and calls all others toadstools; while another person may be familiar with the edible qualities of a number of kinds and use the same method of naming them. Thus it will be seen that what would be a toadstool to one person, would be a mushroom in the vocabulary of another, and with equal propriety in each case, therefore the synonymy of the two terms is established through popular usage. Moreover, no scientific distinction is made between these two terms. It is evident, therefore, that there are edible toadstools as well as poisonous mushrooms.

This question is also suggestive of the prevalent idea that there is some short and reliable test or rule that can be applied and which like a lucky-stone, will guide its possessor in the selection of the good and the avoidance of the harmful kinds of fungi. Thus the collector of fungi for scientific purposes is often warned, by the persons whom he meets, against eating any of the specimens in his basket, while some sure and time-honored formula is condescendingly proffered. The expressions of amazement and incredulity on the faces of these persons when told that all of your specimens except, perhaps, two or three, are edible, are often amusing to see.

Many otherwise well informed persons claim to be able to "tell a mushroom" by some such test as the following: The cap must peel readily; they are pink underside; they should not blacken a silver spoon in cooking; must have no disagreeable taste nor odor; should turn dark when

salt is sprinkled on underside; avoid those having bright colors, etc., etc. These are only a very few of the rules or so called tests that are supposed by many persons to enable them to discriminate between good and bad fungi. It is not strange that the terrible fatalities, that now and then occur from eating poisonous mushrooms, should be found among the ranks of those who have faith in the above means of discrimination. It is only to be wondered at that they do not occur more often. for while some of these rules might serve to exclude "The Deadly Amanita" and its noxious relatives, others are no more to be relied upon than is a horse-shoe over the door in an epidemic of smallpox. Furthermore, most of these rules exclude many of our choicest and most abundant food species of mushrooms.

If then, there is no easy set of rules, no reliable test that will exhibit the danger signal, how is the novice to know when gathering the fungus offerings of woods and fields, that he is not placing himself in a fair way to become a subject for the coroner and the undertaker?

The real question to be answered is, how can we learn to know the edible from the poisonous species of mushrooms and toadstools?

The popular demand for some short and easy way to make this discrimination, has often led to the adoption of some artificial means in lieu of the only safe and natural method, the use of the botanical characters of each fungus. It is desirable, therefore, in gaining a correct conception of the mushrooms and toadstools, to realize that each kind has certain definite characters which, when familiarized, admit of ready recognition. It is also a well established fact that some species of fungi are wholesome while others are poisonous. Thus it logically follows that if a person is familiar with the specific characters of any species of edible fungus, he may safely collect that species for food. This is the method pursued by many persons who know only one or two kinds, and so long as they have recourse only to those species with which they are familiar they incur no more risks than in the use of other articles of food. Therefore, a preliminary answer to the foregoing question would be, before using any mushroom for food, learn to recognize it by its botanical characters, or at least *become so familiar with its appearance that it can be recognized under all circumstances.*

If, in addition to such information, the specific characters of the few poisonous kinds, apt to be met with, are also familiar to the mushroom hunter, an additional safeguard is assured, and one which will enable him to discard those species which are the most common cause of disaster. One of the most encouraging features of this subject, contrary to the usual supposition, is the fact that most of the species of mushrooms and toadstools are either edible, or are at least possessed of no dangerous qualities. And fortunately the comparatively few species, which do possess a dangerous and poisonous principle, also have a structural character which when familiarized, admits of ready identification.

VEGETATIVE OR EARLY STAGE OF GROWTH.

To the ordinary observer, mushrooms and toadstools seem to be of spontaneous origin. This is not to be wondered at when we see them standing in profusion, where only a day or two before nothing but grass or bare ground was seen, or on going into the nearby woods, find a familiar log or stump covered with fungus excrescences. But that which

appears to come up in a night, is really the result of growth that has occupied weeks and possibly months or years in its development. This vegetative part of the fungus, hidden from sight in the soil, rotting wood or decaying vegetable matter, is known to the botanist as mycelium, and to the mushroom grower as spawn. This mycelium consists of slender branching threads, delicate as the web that the spider spins, branching again and again, penetrating all parts of the substance in which it grows in search of food materials, and finally forming root-like strands or felted masses composed of interwoven threads.

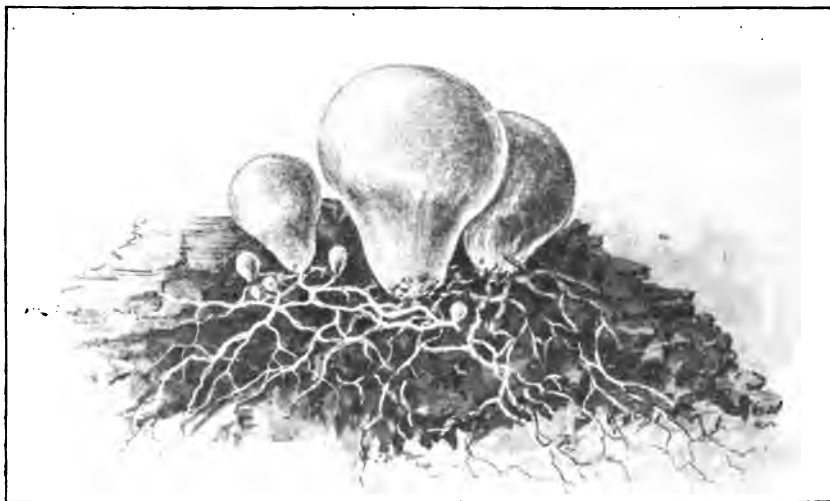


Figure 2. Root-like strands of mycelium of the pear-shaped Puff-ball growing in rotten wood. Young puff-balls in the form of small, white knobs are forming on these strands. Natural size. — (Original.)

These branching and interlacing strands and threads of mycelium can often be found by overturning logs and rotting leaves in the woods where they sometimes appear, rivaling in delicacy and beauty the crystal tracery of Jack Frost's breath on the window pane. Under the proper conditions of moisture and temperature and in the presence of materials that will furnish food, this growth of mycelium goes on with considerable rapidity and may cover considerable areas.

Fungi differ from most other plants in the fact that they have no leaves nor anything to do the work of leaves, consequently they are unable to assimilate the raw food materials of the soil and air, but must depend on animal or vegetable matter already formed. For this reason mushrooms and toadstools are found most abundant where such materials are in a state of decay, as about manure heaps, in fertile fields and meadows, among the decaying leaves and sticks in the forest, while logs and stumps furnish a favorite resort for many kinds. Indeed, this process of decay is largely due to the dissolving and absorbing action of the mycelium of fungi on the tissues of these substances. This effect is very noticeable

in those kinds which grow on wood. It is surprising to see how soon the fallen branch or prostrate trunk becomes the prey of the insidious and greedy mycelial threads of such fungi.

This silent, unobtrusive growth of the mycelium continues until a sufficient development has been reached for the production of the fruiting stage of the fungus in the form of the mature mushrooms. Or, if but little moisture is present, this growth is correspondingly slow, being entirely checked when dry. On renewal of the water supply, as during a rainy spell, the mycelial growth is resumed. Soon little enlargements or knobs appear on the largest of the mycelial strands or at some portion of the mycelial system. These rapidly enlarge, fed from the connecting threads of the mycelium, until in many cases we can detect the form of the mature fungus into which they are to develop. If moisture is now plentiful and the temperature favorable, the succeeding stages are rapid. The small, closely packed cell-filaments of the little knobs rapidly expanding into those of the full grown fungus.

This in brief, is the general process of development of the flesh fungi which comprise the mushrooms and toadstools.

FUNGUS SPORES.

The ultimate object of every fungus is spore production. These spores are microscopic bodies produced in immense numbers on the fruiting form of the fungus and so small and light that they float in the air as an invisible dust. Many of them fall on the ground near the place where



Fig. 3.

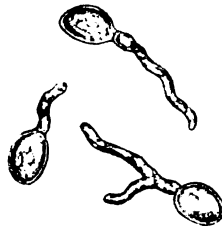


Fig. 4.

Figure 3. A few of the different shapes of fungus spores. Highly magnified.

Figure 4. Mushroom spores germinating by sending out a slender germ-tube.—(Original.)

they are produced and are washed into the soil or carried away by rains. Others are wafted away in every breeze, possibly carried for days on the wings of the wind, to be brought down at length, by dew or rain, long distance from their starting points. In this way they are carried to the ends of the earth, dusted into every crack and cranny, on every exposed surface of wood or humus, or cast upon some water's surface. Like the seed, mentioned in the parable, many of them perish, but they are sown with a generous hand, and some are sure to fall into good ground.

Those spores which find a favorable resting place may germinate by sending out, usually, a slender thread-like tube, which at once branches out in search of food materials. In this way the mycelium is established.

STRUCTURE AND CLASSIFICATION OF FUNGI.

If a small fragment of some fleshy fungus is examined with a microscope of high magnifying powers, it will be found to be made up of interwoven, branching, tubular filaments, often with delicate partitions dividing the tubes into cells. Thus the body of the fungus is shown to be constructed from the same kind of threads as the mycelium, in fact, it is a continuation of the mycelial filaments closely interwoven and often grown together. In the densest portions of some very hard fungi the mycelial filaments are not only interlaced and grown together, but are divided into short cells, by numerous cross partitions, while the walls are much thickened. In soft fungi the mycelial tubes are loosely interwoven and have thin walls with fewer partitions.

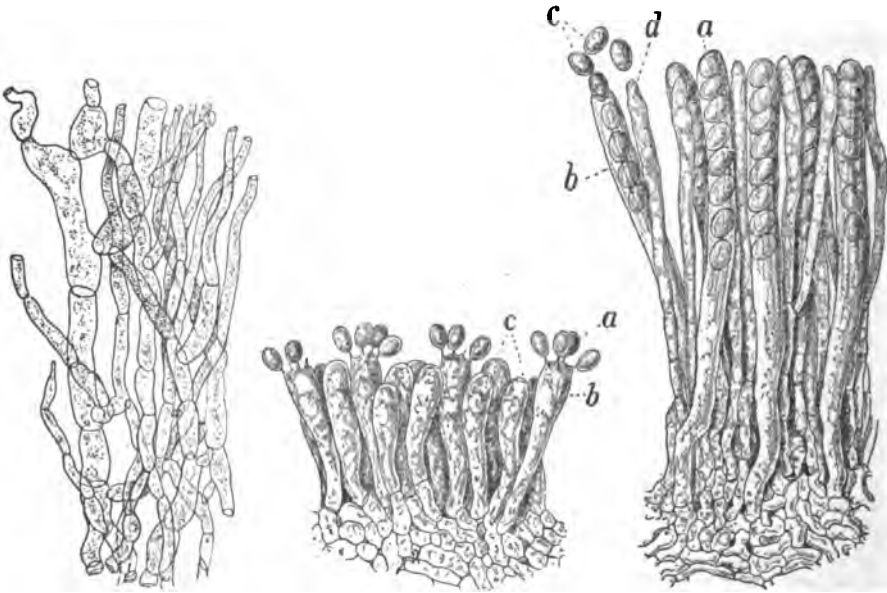


Fig. 5.

Fig. 6.

Fig 7.

Figure 5. Small portion from the stem of a Morel showing cell-filaments. Highly magnified.

Figure 6. Small portion of a section through the spore-bearing layer (hymenium) of a mushroom which produces its spores on the ends of cells called basidia. (a) spores; (b) a basidium; (c) sterile cells. Highly magnified.

Figure 7. Small portion of a section through the spore-bearing part of a Morel, in which the spores are produced in little sacks known as asci. (a) an ascus; (b) an ascus discharging its spores; (c) sterile cells. Highly magnified.—Original.)

Fungi are classified according to their various modes of spore production. The fleshy fungi belong in two great classes known as Basidiomycetes and Ascomycetes. In the former class the spores are formed on the ends of little elongated cells called Basidia, while in the latter

they are formed in minute closed sacks known as asci. In most cases only certain limited portions of the fungus take part in this process of producing spores, these parts being covered with a thin layer of tissue called the hymenium or spore-bearing layer. This hymenium, therefore, is made up partly of basidia or of asci. This depending upon whether the species belongs to the first or to the second of the two classes mentioned.

The Basidiomycetes are further subdivided into the Hymenomycetes, in which the hymenium is on some exposed part of the fungus, and the Gastromycetes in which the hymenium lines the interior of irregular cavities in the body of the fungus.

The shape of the hymenium-bearing part is made use of in subdividing each class and group. Thus, in the Ascomycetes the hymenium is found covering the outside of clubs, wrinkles or ridges, spreading over flat surfaces and lining the interior of cups. While in the Hymenomycetes various forms of spines, clubs, gills and pores furnish a foundation for the spore-bearing layer.

METHODS OF LEARNING TO RECOGNIZE EDIBLE FUNGI.

There are three principal ways by which the beginner, who wishes to collect fungi for eating, may learn to know the edible kinds. First, the personal physiological test suggested in Wm. Hamilton's book on edible fungi. This consists of chewing a very small piece of the fungus, whose edible properties we wish to determine, and then ejecting it without swallowing the juice. If no unpleasant symptoms arise within the next twenty-four hours, another very small piece is to be chewed and a little of the juice swallowed. Should no indications of poisonous qualities appear after another period of waiting, a slightly larger piece may be chewed and swallowed. If the piece used is not larger than a small pea no harm will result even if a poisonous species were being tested. In this way a person may learn to recognize certain kinds as edible and to enlarge his list of such species gradually. While this method may be followed with safety by a careful person, it is not especially recommended to persons who are not willing to make a physiological laboratory of their stomachs.

The second method consists of learning the characters of edible species from some person already familiar with them, and while this is the best way in which to study the subject, only a few persons in the state are apt to have the benefit of a personal instructor who is at all competent to give reliable instruction along this line.

Therefore, the majority of persons who wish to know some of the edible fungi will probably rely on the third method which consists of the study of carefully prepared figures and descriptions in books and bulletins.

The writer recommends that the novice become familiar with a few of the commonest and most easily recognized kinds of mushrooms and that he gradually widen his acquaintance with these plants, thoroughly learning the structural characters and habits of each until they can be readily distinguished. Do not be in too great a hurry to know all the edible species which grow in your neighborhood. The gardener does not learn to recognize all the varieties of vegetables in one season. However, a few new acquaintances may be gained each season if one has books and

pictures to refer to. Moreover, it is no more difficult to distinguish between many of the common kinds of fungi than it is to learn to separate peaches from apples or potatoes from turnips.

In this Bulletin the writer will confine himself to two groups of fleshy fungi which have been selected on account of the ease with which they may be identified, and because they do not contain any poisonous species.

THE EARLIEST FUNGI.

About the earliest mushrooms to be looked for are the Morels; those fungus counterparts of the Spring Beauty, the Dogtooth Violet and the Trillium, plants which are able to spring into early bloom by means of a stock of nourishment accumulated during the previous season. Thus these earliest species of fleshy fungi are able to appear as soon as the frost leaves the woods because they have a mycelial system which became well established during the summer before, to be matured by the frosts of winter and awakened into activity by the warmth and moisture of spring.

The Morels are so characteristic in appearance that when they are once identified it is an easy matter to recognize them ever after. And as none of them are known to be poisonous or disagreeable, they form one of the safest groups for the beginner to collect.

On examining a specimen two parts are noticed,—a hollow stem of varying slenderness, supporting at its apex a head or cap (the pileus), covered with wrinkles or ridges. These ridges branch and unite, thus forming pits of varying shapes and sizes.

The spore-bearing layer or hymenium covers the sides of these ridges and is thereby largely increased in area. Under a compound microscope, a thin section through one of the ridges shows the hymenium to be composed of slender spore-sacks (asci) standing side by side, like blocks in a pavement. Fig. 7. As the spore-bearing layer matures the pressure becomes great enough to rupture the exposed ends of the asci when the spores are quite forcibly expelled.

The spores, usually eight in each ascus, are mostly of an ochre yellow color when seen in a layer on white paper. They may be readily obtained from mature specimens by placing the cap on white paper and covering with a paper cone or box for a few hours.

Several of the so called species of morels are to be found in Michigan. On account of their close resemblance most of these species are separated with much difficulty, even by the expert botanist. However, this enables the beginner to recognize them all the more readily as a group, and as the species are equally desirable for eating, the novice will not need to hesitate when the exact species is not recognized.

The Two-Spored Morel. (Morchella bispora.)

This morel derives its name from the fact that each spore sack (ascus) contains two large spores, while those of the other morels contain eight spores each. The pileus or cap is thimble-shaped, with the ridges running mostly from the top to bottom and it is fastened to the stem only at the very apex. Color, buff or brownish yellow, white underneath. The smooth, white stem is usually three or four inches tall, hollow, and often a little swollen near the base. The whole fungus is tender and fragile.

This is one of our earliest morels, often appearing with the opening of the pussy willows and the advent of the yellow warbler. It is also the rarest and most delicate member of its tribe, however, it sometimes occurs in considerable numbers, frequenting rather low, moist woods amid decaying leaves.

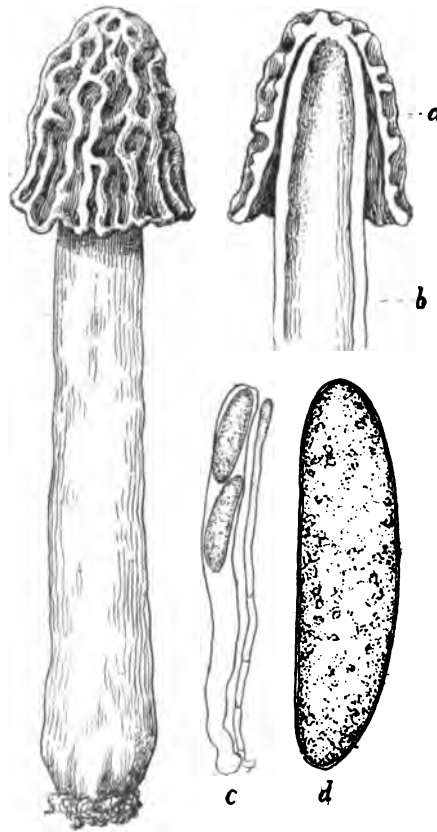


Figure 8. Drawing of two-spored Morel (*Morchella bispora*). (a) cap or pileus; (b) stem, in section, about natural size; (c) an ascus containing two large spores; (d) a spore. Highly magnified.—(Original.)



Figure 9. Two-spored Morel amid its natural surroundings.—(Original.)

The Half-Morel. (Morchella Semilibera.)

As its name implies, this morel has the lower half of the pileus free from the stem. The pileus is mostly conical in shape with longitudinal ridges and pits. The white stem is somewhat mealy or scurfy, hollow and often swollen at the base. This fungus is usually a little later than the two-spored morel, grows in similar places and is not usually common.

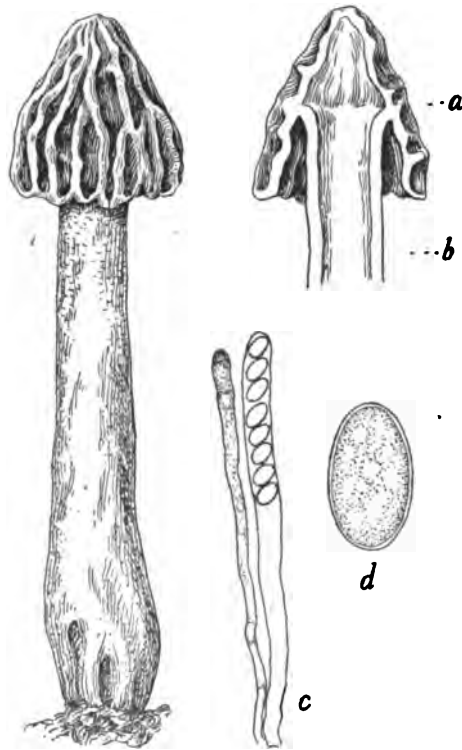


Figure 10. The half-free Morel (*Morchella semilibera*). (a) cap; (b) stem, in section, about natural size; (c) an ascus containing eight spores; (d) a spore. Highly magnified. —(Original.)

The Narrow Cap Morel (M. angusticeps) and the Conical Morel (Morchella Conica). .

These two morels are so nearly alike in many cases as to make it very difficult to separate them satisfactorily. In both species the cap is considerably longer than broad, in some cases very narrow and pointed, in others broadly conical. The ridges extend from base to apex, being con-



Figure 11. The Narrow-cap Morel (*Morchella angusticeps*). Natural size. (Original.)

nected at intervals by smaller ridges and forming long, narrow pits. The pileus which possesses a brownish drab color, is wholly attached to the stem, thus having no free margin. The typical Narrow-cap Morel has a stem which is nearly as large as the cap in diameter and varying much in length, while in the true type of the Conical Morel it is considerably narrower than the cap. Both have whitish hollow stems which are often scurfy on the outside. They sometimes occur in orchards, but are apt to be found in the vicinity of black ash trees, in low woods and along their margins. They often appear early in April, even before frosts have ceased.



Figure 12. The Conical Morel (*Morchella conica*). Natural size. — Original.)

The Esculent Morel. (Morchella esculenta.)

This is the common morel and the most abundant of its tribe. It is distinguished principally by the more rounded shape of the cap, and the irregular pits which are formed by the ribs extending in all directions. The color is greyish or leaden in young specimens, but changes to a buff in mature plants. They are found singly or in groups, frequenting the borders of woods, appearing along the lane, in old orchards, and in the vicinity of evergreen trees. A colony of them lifting their sponge-like heads in the green grass is an inspiring sight to the fungus epicure who learns to look for them each season in the same haunts.

All morels should be crisp and fresh when eaten. If they have been frosted several times or softened by rain and age they should be rejected, as they prove somewhat indigestible under these circumstances.

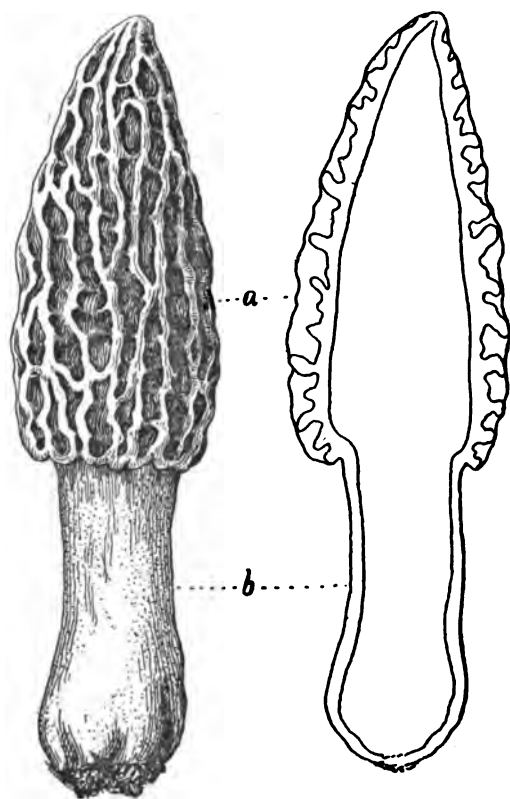


Fig. 13.

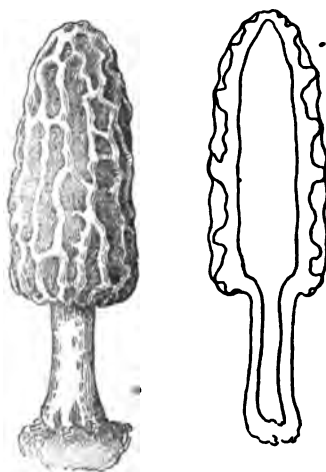


Fig. 14.

Figure 13. The Conical Morel. (a) a cap or pilius; (b) stem. The right hand figure represents a lengthwise section.

Figure 14. The Delicious Morel (*Morchella deliciosa*). Natural size.—(Original.)

PUFF-BALLS.

Puff-balls belong to one of the most interesting groups of fleshy fungi. Every person who frequents the fields and woods is familiar with the dust-filled, cotton-stuffed balls, which invite the attack of the small boy with a stick, but only the few are aware of the fact that they are a desirable and safe addition to the fungus bill of fare when in their early stage of growth. When in this condition they are quite solid and white inside considerably resembling cottage cheese in appearance. However, upon the first signs of discoloration and wateryness inside they should be rejected, for this is an indication of over-ripeness for eating.

The Lead Colored Puff-Ball. (Bovista plumbea.) Fig. 16.

A description of the development of one member of the group will suffice for all and for this purpose one of the small species has been chosen, the little Lead-colored Puff-ball.

A warm rain almost any time during spring and summer months is



Figure 15. The Common Morel. This lot was collected in a short time from a woods on the Michigan Agricultural College farm.—(Original.)

sure to bring this fungus into sight especially in sandy pastures. About one inch in diameter, it is nearly spherical in shape, quite smooth, and creamy inside and out.

Be on hand, if you want them, for they are very apt to cater to the appetites of the greedy larvae of certain insects if left for many hours.

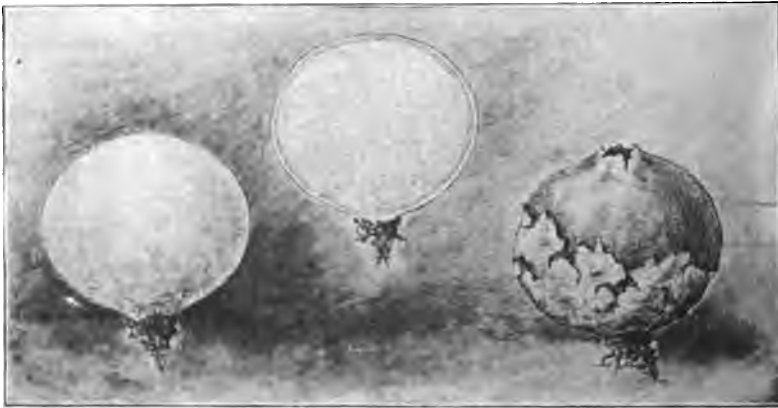


Figure 16. The Lead-colored Puff-ball (*Bovista plumbea*). The left hand figure represents this fungus when young, the central figure shows the same in section, while the mature condition of the fungus is shown at the right. Natural size.- (Original.)

This fungus is covered with two layers or coats, the inner one thinner and tougher than the outer. The cheesy interior portion is quite spongy, due to the presence of numerous minute, irregular cavities, each lined with a spore-bearing layer or hymenium. The thick walls surrounding these cavities are composed of interwoven mycelial filaments, some of which are much branched and thick walled, while the others are slender, thin walled and are connected with the basidia, or spore-bearing cells, in the hymenium. As the puff-ball matures the white interior portion becomes yellow or brownish and water soaked due to the melting of the basidia and thin-walled threads into a liquid condition.

This moisture soon dries out the color becoming darker, while the thick-walled branched threads remain as a cottony mass, dusted full of spores. In the meantime the outer coat of the puff-ball has cracked and fallen away leaving the inner one like a lead-colored paper bag. A small opening forms in the apex of this bag and the mature puff-ball is ready to be stepped on.

Only a slight pressure is needed to send out a dark brown smoke-like puff of spore dust which quickly vanishes in air. The elastic property of the cottony stuffing causes the puff-ball to expand to its original size as soon as the pressure is removed and it is then ready for another squeeze.

The Separating Puff-Ball. (Lycoperdon separans.)

This is another puff-ball about the size of the foregoing one. Its outer coat is white at first and thickly covered with pointed warts or spines of the same color. This coating crumbles away in little fragments as the fungus ripens, thus uncovering irregular patches of the

inner coat which has changed from white to a yellowish brown. It also occurs commonly in fields, pastures and door yards during the growing season.

The Cup-Shaped Puff-Ball. (Lycoperdon cyathiform.) Figs. 17, 21.

Among the larger puff-balls the present species is perhaps the most common as well as one of the best for the table. When full grown it is about once or twice the size of one's fist. It is usually in the form of a flattened sphere seated on a narrowed base.

The covering, at first white, becomes stained with purplish hues as the



Figure 17. Three specimens of the cup-shaped Puff-ball (*Lycoperdon cyathiform*). The surface is just beginning to crack open and to show purplish stains. About one-fourth natural size.—(Original.)

fungus matures, cracking into somewhat angular areas and then flaking away when dry thus exposing the purple spore-mass. This the wind scoops out in time leaving only the cup-shaped base, the lower part of which does not change to a spore-mass (Fig. 21). Old pastures furnish a favorite place for this puff-ball where they sometimes occur in groups of several individuals.

The Engraved Puff-Ball. (Lycoperdon caelatum.) Fig. 18.

This puff-ball is much like the preceding one in structure and behavior but can be readily distinguished by its larger size and the yellowish olive color of the mature spore-mass. The sterile base is sometimes the larger part of the fungus and is often anchored to the soil by a heavy root-like growth below. It is found in much the same places as the preceding species.



Figure 18. The Engraved Puff-ball (*Lycoperdon caelatum*). About one-half natural size.
—(Original.)

The Giant Puff-Ball. (Bovista gigantea.) Fig. 19.

The Giant puff-ball, a veritable fungus football, is not only the Goliath of its tribe but, when well developed, has no other rival in size among fungi. Thus marvelous stories are sometimes told about the dimensions to which this fungus occasionally attains. The largest specimens seen by the writer measured nearly sixty inches in circumference and weighed fifteen pounds; a fungus omelette for a whole neighborhood.

Its surface when young resembles white kid leather while its resemblance to a huge loaf of unbaked bread is very striking. How many of these fungus delicacies are kicked into oblivion every season by persons unfamiliar with their appetizing possibilities, there is no record to show; it suffices to say that the well informed fungus hunter would as quickly think of demolishing a basket of fresh eggs which he might happen to find as to destroy a good specimen of this fungus.

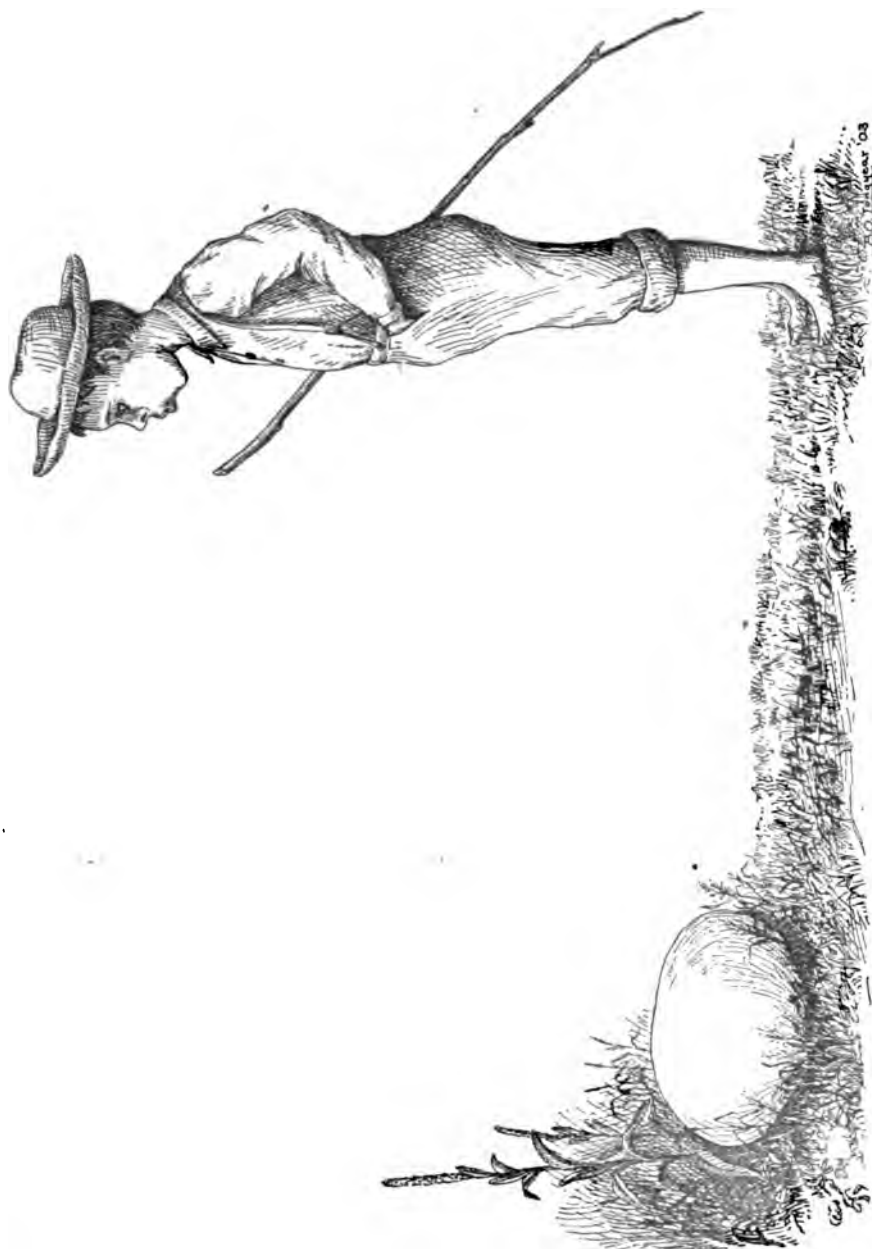


Figure 12. The Giant Puff-bell (*Bovista gigantea*).—(Original.)

Like the two preceding puff-balls the spores of this species are distributed by the wind after the breaking away of the outer layers. The enormous number of spores which one of these puff-balls contains is as much beyond comprehension as the number of flakes in a snow storm. It occurs during the summer in fields and pastures.

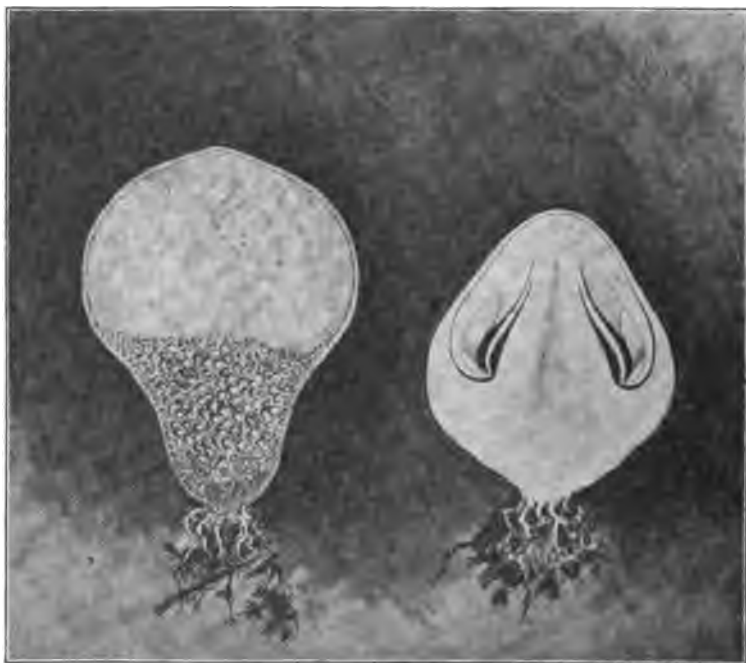


Figure 20. The left-hand figure represents a vertical section through a young plant of the Gemmed Puff-ball, showing the cellular structure of the stem-like lower half. This portion does not change into a spore mass but remains after the spores are discharged from the upper part. The right-hand figure shows a vertical section through the young, or egg stage of an amanita, a very poisonous fungus which grows in woods and which might possibly be mistaken for a young puff-ball, if not cut open. This fungus forms just below the surface of the soil and finally bursts the outer covering sending up a parasol-shaped mushroom. Natural size. (Original)

The Gemmed Puff-Ball. (Lycoperdon gemmatum.) Fig. 20.

This little puff-ball is often quite abundant in woods and about decaying wood lying on the ground. The upper part is somewhat spherical and narrows into a stem-like base. The surface is adorned with little pointed warts which fall away at maturity leaving the surface marked with slight indentations. It is about one and one-half to two inches in height but sometimes makes up in numbers what it lacks in size. Thus in one case the writer found an area of several square yards, in a rather low woods, which was so thickly covered with these little puff-balls that it was almost impossible to cross it without treading on many of them. At first entirely white they become yellowish brown throughout, the spores escaping when mature through a small opening in the top.

Several other species of puff-balls are sure to be met with in our state by those who hunt mushrooms, but as they do not differ much in structure or edible qualities from those already described it seems unnecessary to give them special mention in this connection.

RECIPES.

Collecting.—In collecting morels and puff-balls, or any other fungi intended for eating, discard all specimens that are overmature or infested with larvae. Puff-balls should be perfectly white inside when broken open. Yellowish stains in the center or near the base are signs of approaching ripeness and although not necessarily poisonous in this condition they develop bitter or unpleasant flavors, unfitting them for use as food. If dirt and adhering soil be removed when the plants are being collected much trouble in washing them clean may be avoided.

Cooking.

A great many ways have been followed in the cooking of edible fungi; in brief they are adapted to almost any treatment given to the oyster. Thus they may be stewed, baked, fried, broiled and escalloped, and made into croquettes or pâtés. Certain kinds, however, are treated in ways better suited to retaining or bringing out their natural flavors.

The following recipes have been selected as being specially adapted to the morels and puff-balls:

Morels.

Fried.—Wash, drain, roll in flour, fry in butter or fat, serve hot.

Stuffed.—Select the freshest specimens, open the stems at the base, wash carefully and wipe, fill with veal stuffing, anchovy, or any other rich stuffing, close the ends, bake or dress between thin slices of bacon. Serve with a sauce.

Simple and dainty.—Split the morels lengthwise, wash, drain, fry lightly in butter about twenty minutes, season and serve on hot toast.

Puff-Balls.

To fry.—Remove the outer rind, slice, dip into beaten egg, then into bread crumbs, fry until lightly browned in butter or fat as for French toast. A batter of milk and egg may be used in which to dip the slices before frying. Serve on a hot plate.

To stew.—Cut into small pieces, boil for fifteen minutes in a little water, pour off the water, dust with a little flour, add a small quantity of milk or cream with butter, salt, pepper, and lastly a little chopped parsley, stew slowly for five minutes, serve. They may also be used in pâtés.

—McIlvane.

Salads.—These may be made from the puff-balls, either raw or stewed, by mingling with any of the usual salad materials. Use the ordinary salad dressing.



Figure 21. The Cup-shaped Puff-ball. The wind scoops out the dry spore-mass and leaves the sterile cup-like base. —(Original.)

VEGETABLE AND BUSH FRUITS.

BY L. R. TAFT AND M. L. DEAN.

Bulletin No. 209.

BEANS.

POLE VARIETIES.

Cluster Wax, from D. M. Ferry and Co., is a bean of superior quality. The pods are very tender and remain in edible condition much longer than most varieties. It is a valuable bean for its class and is very productive.

Golden Lazy Wife, from Wm. Henry Maule, is a very prolific variety. The pods are a bright golden color, very numerous and of good quality.

Nox All, from the same seedsman, is a green-podded sort and has some merit.

Royal Corn, from the Livingston Seed Co., is a productive bean of good quality. The pods are very tender.

Southern Prolific and White Crease, were both received from D. M. Ferry and Co. White Crease seems to be a selected strain of the White Pea bean and is a valuable variety as a dry shelled bean. Southern Prolific has tender pods and snaps readily but it is not superior to many of the standard sorts.

Worcester Pole, originated at Worcester, Mass., and is prized by market gardeners for its productiveness. Its quality is good and it has a long edible maturity. The beans are not clear white but are of good flavor as shelled beans.

BUSH BEANS.

This class includes a large number of varieties of good quality.

The Valentine type stands at the head for green pods and the Wax or Butter beans for yellow-podded sorts.

Brittle Wax, from Burpee, is a very productive green-podded variety. The pods snap readily and have a mild flavor.

Bountiful, from Henderson, is all that its name implies as to its productiveness. The pods are long, large, stringless and of a bright green color.

Coffee Berry, received from the Great Northern Seed Co., is a mere novelty, of no especial value. The kernels are small and light colored. The vines grow about two feet high.

Double Barreled Wax and First in the Market were received from D. Landreth and Son. First in the Market is a quick maturing green-podded sort of medium quality, but the edible period is very short. Double Barreled Wax is a selected strain of the wax type of good quality. The pods are broad and thick and do not become tough.

Giant Podded Stringless, from Maule, is a good green-podded sort. It is very productive and the pods are large, long and meaty. A good mid-season variety.

Jones Stringless, from D. M. Ferry and Co., has white seeds and is of excellent quality for an extra early variety.

Knickerbocker, Longfellow and Market Wax were all received from Peter Henderson and Co., New York. Knickerbocker and Longfellow are green-podded and of good quality. Market Wax is a good wax sort.

North Star, from Great Northern Seed Co., is a green-podded snap bean of good quality. The pods are long, tender and mature very early.

Pencil Podded Wax, Powell's Prolific and Quarter Century were received from Livingston Seed Co. The Pencil Pod is a wax bean of standard quality. Powell's Prolific is an abundant bearer, but the pods are a little tough. Quarter Century is a bush Lima but did not mature this season.

Sunshine Wax, from Bolgiano and Son, is a carefully selected strain of good quality. The pods are bright colored, tender and pleasant. It is a good, medium-early variety.

Trucker's Delight, from Holmes, is a Lima of considerable promise.

Levianthium, from Henderson and Co., is another choice Lima, but the weather was so wet that none of the Limas matured sufficiently to show their quality.

CABBAGES, 1902.

About the same varieties of cabbage, cauliflower, kale, kohlrabi, broccoli and Brussels sprouts were grown as in 1901. The season was such that many of the plants failed to head and a poor trial resulted. The broccoli developed some very fine heads equal to any of the cauliflower in quality.

The list of early varieties of cabbage included All Head, Early Jersey Wakefield, Etampes, Express, Henderson's Early Summer and White Giant from Vaughan Seed Co. Alpha from Currie Bros.; Base Ball, Flat Head, No. 78 and Stonehead from Burpee; Charleston and Early Drumhead from D. M. Ferry Seed Co.; Earliest from Gregory; Cracker Jack from Maule; Drumhead and Large Early Jersey Wakefield, from Dreer; Sure Crop from Mills.

There were several varieties that matured good heads early in the season. Base Ball and Cracker Jack were two varieties to develop the

earliest heads but they were very small. Etampes, followed by Early Jersey Wakefield and Henderson's Early Summer are varieties of good quality that can be relied upon.

White Giant produced some very large heads of extra fine quality. It was a little later than Henderson's Early Summer.

With the medium and late varieties better results were secured than in 1901.

Succession and Autumn King for medium, and Flat Dutch and Mammoth Rock Head for late, will generally prove satisfactory.

The American Drumhead Savoy gave some excellent heads of this type of cabbage and its culture should be encouraged. The quality is superior to the smooth leaved sorts.

The Brussels Sprouts were of better quality than in 1901. The small heads were solid, tender and of good flavor.

Some choice heads of cauliflower were grown of several varieties including the Erfurts and Snowball.

LETTUCE.

The test included the new varieties or novelties sent out by the different seedsmen, as well as most of the old kinds. The tests were made in the open ground.

All Heart, from Dreer, is a large, coarse-growing variety of the heading type. When given plenty of room in the row, the heads are large and attractive. The heart is tender and mild-flavored. It is of choice quality but, if crowded in the row, the heads are small and tough.

Continuity, Russia and No. 903 are three varieties from W. A. Burpee and Co. Continuity is a large, solid-headed sort having a tender, mild-flavored center. The outer leaves are thick, rather dark green and completely cover the heart. It is a good mid-season sort. Russia and No. 903 did not develop any traits of special value.

Crumpled Leaf, from R. and J. Farquhar and Co., is a large, heading sort. The foliage has a very dark green color and is coarse, requiring much room in the row. The heads are of good quality and mature early for so large a variety.

Crystal Head is a very quick maturing variety for so large a sort. The heads are of superior quality.

Density, Immensity, Precocity and Express were received from Peter Henderson and Co. Express is a medium-sized, close-growing lettuce of the Cos type. Precocity is a small, quick-maturing head variety. Density follows it in season, but is not as compact and has colored bordered leaves making it very attractive. Immensity has very large, coarse-growing heads, but they are compact and of good quality for such large heads. They make a good succession of head varieties.

Elliott's Leviathan, from Elliott and Sons, as last season, proved to be a valuable heading sort.

Rawson's Hot House was received from the same parties. It is a standard among the forcing varieties and is also a choice heading sort for garden culture.

Farmer's Pride, **Golden Heart** and **White Loaf** are three varieties received from J. Bolgiano and Son. They are all heading sorts and of good quality, making a good succession through the season in the order named.

Kaiser Wilhelm, **Peer of All** and **Sunset** were received from J. A. Salzer Seed Co. **Kaiser Wilhelm** is a very large heading sort. **Peer of All** is of medium size and very attractive, having a bronze red tint to the outer leaves. **Sunset** is small and dark green in color. The quality of all three is desirable.

Mammoth Black-Seeded Butter, from Livingston's Seed Co., is a standard for a large-growing, delicately blanched head lettuce. The rot bothered it some this season.

Pan American and **Tender and True** were sent out by F. B. Mills. **Pan American** is a heading sort. **Tender and True** is a loose, crinkled-leaved sort. They are both of good quality. **Tender and True** matures early but the seed stalk starts soon so that the edible period is very short.

Silver Anniversary from W. H. Maule, **Sterling** from Northrup, King and Co., **Unrivalled** from J. A. Bruce and Co., and **Unsurpassed** from D. Landreth and Sons are all heading varieties of some merit.

Grand Rapids Forcing was the leading open-heading sort grown.

The head varieties were somewhat troubled with the rot this season, especially the larger sorts. The quality of the head varieties is superior to the open sorts but, in Michigan, the demand is for the **Grand Rapids** type in the garden, as well as for forcing.

NOTES ON PEAS.

Twenty-four varieties of peas were grown in 1902, including some of the common or standard varieties and some others that are types carefully selected from the older varieties and given new names.

Alaska, from D. M. Ferry and Co., is a standard early variety. It is very productive and matures evenly.

American Wonder, **Hosford's Market Garden**, **Champion of England** and **Stratagem** were all from the above seedsman and are varieties of superior quality, following each other in season.

Athlete, from Rawson, showed a tendency to run to vines. The pods were scattering. It is a medium-late variety and the peas are of fine quality.

Blue Beauty, from Thorburn, is quite productive. The vines are about two feet high; pods three inches long by one-half inch wide and contain six plump, sweet, tender peas.

Bloomsdale, from Landreth and Sons, is quite tall and runs to vines. The pods are numerous and well-filled. Matures about the same season as Stratagem.

Dwarf Jumbo, from Salzer, was very slow to germinate. The vines are about eighteen inches high; pods few but large and filled with peas of the highest quality.

Dwarf Telephone, Rough Rider, Scorchers, Tom Thumb and Wife's Pin Money were all received from John A. Salzer. Dwarf Telephone made about one-half the growth of Champion of England but matured nearly at the same time. The peas are of superior quality. Rough Rider was of the Market Garden type, but lacked in productiveness.

Tom Thumb has a small low-growing habit. The vines are spindling; pods scattering and the peas are of only medium quality. Wife's Pin Money resembled Champion of England in growth and quality. The pods are numerous and the peas superior in quality. Scorchers is a quick-growing variety of great productiveness, but only medium in quality.

Giant Podded Sugar Pea, from Elliott and Sons, and Giant Podded, from Livingston, were nearly identical. They are both good varieties.

Giant's Favorite, from the Great Northern Seed Co., has been grown here several times. It seemed to be true to type, productive and of good quality. Matured at the same time as Champion of England.

Philadelphia Extra Early, from Thorburn, was one of the first to reach edible maturity. The vines are productive and the peas are of medium quality for so early a variety.

Perpetual and Prodigious, from Maule, are two tall-growing varieties of superior quality. Perpetual lacks in productiveness and has a long edible maturity, but Prodigious is very productive and the quality of the peas unexcelled. Medium to late in season.

Reliance, from Henderson, is a tall, rank grower, quite prolific. Pods well filled with choice peas. It is a medium to late variety.

Surprise, from Henderson, as previously stated is a productive, valuable variety for market garden purposes. It matures early and evenly.

Teddy Roosevelt, from Northrup, King and Co., is a very desirable, large-growing variety. The vines are vigorous and productive and the peas are of the choicest flavor. They are about the same in season as Champion of England.

SWEET CORN.

The thirty varieties of sweet corn included a few of the standard kinds and some of the leading new sorts.

The Mammoth Cory holds its place among the quick maturing sorts, although it is not strictly a sugar corn.

Champion and Early Evergreen are good varieties for second early.

Country Gentleman should be included in every collection, and Stowell or Mammoth usually lead for late varieties although some of the newer sorts that are selected strains from the older ones are of equally choice quality.

Baltimore, from Turner and Co., Baltimore, Md., matured in about eighty-five days. The stalks averaged about five feet in height; ears six inches in length and contained ten rows of kernels. The kernels were short and lacked in quality, but it is a quick growing variety.

Banana, from Farquhar, was about ten days later than Baltimore. The size and habit of growth were about the same but the quality was better, the kernels being sweeter and more tender.

Cosmopolitan, from W. A. Burpee and Co., is a good addition to the list of early varieties. It reached edible maturity a few days later than Baltimore. The ears are longer, averaged twelve rows and the kernels are broad, deep and of superior quality.

Don, from Weeber and Don, is of good quality for a medium-early variety.

Evergreen Early, from D. M. Ferry and Co., and Dobson's Evergreen Early, from J. C. Vaughan Seed Co., are nearly identical. The ears are long and well-filled with broad, deep, tender, sweet kernels. They averaged one ear per stalk. They are choice mid-season varieties. The ears averaged nearly a pound in weight.

First Crop, from Farquhar, and First of All, from Salzer, are small-growing varieties of the Cory type. The stalk and ears are small. First of All matured five days earlier than First Crop, which was edible in ninety days from planting.

Ford, from Ford Seed Co., is of the same type as First Crop and closely resembled it in every detail. Its early maturity is its most valuable trait.

Malakoff was received from the same source. It is a small, quick-maturing variety from Central Asia. The ears are small and short. Stalks only about three feet high. It reached edible maturity one of the first in the list, but the quality is poor.

Giant and Giant Improved are two varieties from W. H. Maule. Giant is classed as one of the desirable medium early varieties. The ears are good sized, symmetrical and well filled with choice kernels. Giant Improved is some later and the ears are larger but the quality is about the same.

Honey, from the Ford Seed Co., is quite a novelty. The stalks, leaves and many of the husks are dark red. The cob is usually red, but the kernels are a rich cream white, of good flavor. The ears are small. It matured in about 105 days.

La Crosse, from J. A. Salzer, is a medium early variety much like Mammoth Cory.

Market Early, from both Ferry and Vaughan, matured among the first varieties. They are identical in type and of medium quality.

Melrose, from Thorburn, is a variety of good quality. It has been previously described.

Metropolitan, from Henderson and Co., was about ten days later than Cory. The ears averaged about six inches in length and contained twelve rows of kernels of medium quality for an early sort. It is productive and a strong grower.

Neck, Red Cob and White Cob were received from J. Bolgiano and Son. Neck is a quick growing variety of medium quality. White Cob comes next in size and maturity, and Red Cob is a larger late sort of good quality. The latter has colored cobs. They are all of good quality.

Peep of Day, from Vaughan, is an extra early dwarf variety. It usually smuts badly and its only value is as an extra sort.

Perry's Hybrid, from Ferry, is a corn of excellent quality for a second early.

Premo, from both Bruce and Holmes, was identical. It is a medium early variety of some value but the ears are small.

Ringleader, from Rennie, reached edible maturity only five days behind the earliest sorts. It is an eight-rowed variety of medium quality for an early corn.

POTATOES.

One hundred twenty-five varieties of potatoes were grown in 1902, fifty of them being early and the balance late varieties. The seed was nearly all grown here. A few varieties being obtained from the following parties:

Farmer Seed Co., Faribault, Minn. Arcadia and Lakeside Champion.
F. B. Mills, Rose Hill, N. Y., Heavy Weight, Nameless and All Seasons.
D. Landreth and Sons, Philadelphia, Pa., Prince Edward.
Wm. Rennie, Toronto, Can., Rose of the North.
Vaughan Seed Co., Chicago, Ill., Hewes.
Wm. S. Huntington, Owosso, Michigan, A quantity of Seedlings.

From the sub-station at Chatham, in the Upper Peninsula, a quantity of potatoes were received, some of which had been pitted, a part kept

in an ordinary cellar and the remainder had been left in the field without digging. The ground was deeply covered with snow all winter, which prevented any injury to the tubers from frost. These lots were planted side by side, but there was no difference in germination or growth, showing that if the ground is thoroughly protected by snow, potatoes are not injured when left until spring. As a general practice, it would be hazardous except in the extreme north.

The season was so wet and cold that the late varieties made a rather poor showing. The potato blights were quite troublesome in some localities but by thorough spraying with Bordeaux mixture, the crop was very free from these diseases. The tubers were very free from scab, the seed having been treated with the corrosive sublimate treatment. The notes will only include some of the best of the newer varieties and those grown this season for the first time. The new varieties are as follows:

Arcadia is one of the most promising. It yielded 251.38 bushels per acre. The vines are upright, rank growers, tubers oval to roundish, flattened in shape. The color is a delicate pinkish white, eyes shallow, giving them a smooth surface. The quality is good. It matured among the earliest varieties.

Hewes yielded 290.26 bu. per acre. The vines were strong growers and the tubers are of good quality and are well bunched in the hill. It is of the Ohio type in season, growth and form.

Prince Edward, is of the Rose type and gave a yield of 155.49 bu. per acre. The tubers are of good quality and resemble the Early Rose in shape and color, but the vines are not as strong growers. They matured a little later than the Early Ohio.

Rose of the North gave the third heaviest yield (451.94 bu. per acre), among the early varieties. It is not a strictly early sort but ranked as a second early. The tubers are elongated, little flattened; eyes shallow, slightly pink in color. The vines are branching, thrifty growers and mature very evenly. The quality of the tubers is excellent and they appear to be good keepers.

Among the early varieties or those ripening with Early Ohio, are several promising sorts.

Coles is a very attractive and desirable early sort. It has been grown here three years and gives an average yield of 225.89 bu. per acre. In 1902 it yielded 300.62 bu. per acre.

Eureka received from Burpee in 1902, averages 272.06 bu., yielding 378.37 bu. in 1903. It has a clear white slightly netted skin.

Michigan still holds its place as one of the leading early white potatoes. In 1903 it yielded 372.19 bu. It has been grown here seven years and gives an average yield of 212.49 bushels per acre.

Minnehaha shows an average for five years of 229.6 bu. In 1902 it produced 360.22 bu., but the tubers were rather irregular in shape.

Norwood was received from Rawson in 1901 and is a choice variety. It yielded 217.69 bu. in 1901 and 279.89 bu. per acre in 1902.

Salzers Early is not a heavy yielder, but it is one of the quickest maturing red varieties in the list. The yield for 1901 was 161.88 bu.; in 1902, 181.14 bu. per acre.

Silver Crown stands among the leaders, both in quality and quantity. Sunlight is very similar. They are two very desirable early white varieties. Silver Crown gave the heavier yield (1901, 180.12 bu.; 1902, 378.38 bu.) while Sunlight gave 215.10 bu. in 1901 and 264.34 bu. in 1902, an average slightly in favor of Silver Crown.

Triumph averaged 284.72 bu. per acre for the past two years, yielding 395.81 bushels in 1902. It is a promising variety.

MEDIUM AND LATE SORTS.

All Seasons, is a mid-season variety, with a yield of 259.16 bu. per acre. The tubers resemble Early Rose, oval in form with pink markings and are of good quality. The tops are upright, with a spreading habit.

Heavy Weight, is of the Carman type. The tops are strong, upright growers. The tubers are well bunched in the hill, white, regular, oval, slightly flattened, very smooth and white. It is an attractive variety but no better than many others of the same class.

Lakeside Champion is said to have originated in the western part of Michigan. The yield (168.45 bu. per acre) was not large, but the tubers which are elongated, and of good size are of fine quality and fairly attractive.

Among the second early varieties, the new Early Carman is prominent. It ripened soon after the early sorts and yielded 388.74 bu. of very smooth, white potatoes.

Daughter of Rose was slightly later. The yield was very promising (456.13 bu.) but the tubers were uneven and rough, Rose colored.

Irish Cobbler (435.40 bu.) holds its place as a second early, ripening only about ten days later than Early Ohio.

Early Peachblow (263.97 bu.) was a few days later than Irish Cobbler and gives an average of 193.96 bu. per acre for seven years.

Pioneer matured nearly with Irish Cobbler and yielded 414.65 bu. The tubers are smooth and of the best quality. Very promising.

LATE VARIETIES.

Among the late varieties there are a large number that resemble Carman No. 3, and many appearing to be either selections or seedlings from that variety. The list includes Battles Best, Dewey, Free Silver, Free Trade.

Good Times, Mark Hanna, McKinley and Million Dollar, all of which are nearly identical in growth and yield.

Cannon Ball represents the large round, red class and is a heavy yielder.

California Russet is a true russet potato and in such wet seasons as 1902, seems to be more immune to the rots than the white varieties.

Enormous, Commercial and Hilers Choice are of a rougher type and have pink markings. The late varieties gave average yields ranging from 190 to 400 bu. per acre.

TOMATOES, 1902.

One hundred varieties of tomatoes were tested in 1902. About one hundred plants each of Beauty, Dominion Day, Ignatum, Lorillard and Trophy were grown to single stems and trained to stakes about four feet high with very good results. The fruit was larger, at least two weeks earlier and very free from the (*cladosporium fulvum*) rot which usually attacks the tomato in wet seasons. The staking method is one of the best ways to grow tomatoes of superior quality. The extra labor connected with this plan is in setting the stakes, pinching out all laterals and tying up the plants, which can be quickly done if attended to. Cultivating can be done much better and the plants can be set closer than when planted in the ordinary way.

Aristobright, Dandy Dwarf, Multi Colors and Royal Colors are novelties sent out by the Livingston Seed Co. last year as numbers 1, 2, 3, and 4. They are described in Bulletin No. 196 and are of no value. Many of the newer sorts are so nearly identical it is difficult to note any distinguishing characteristic.

Bolgiano's Best, from J. Bolgiano and Son, Baltimore, Md., has vines of a rank, spreading habit. It is a medium early variety. Fruits bright red, firm and solid, but with a tendency to be slightly rough.

Acme, early, medium size, purple, rather rough. Very productive.

Advance, extra early, small to medium, bright red, very smooth. Good.

Atlantic Prize, early to mid-season, medium size, bright red, slightly rough.

Beauty, second early, medium to large, purple, smooth, very desirable.

Belmont, mid-season, medium to large, Trophy type, bright red, smooth.

Best of All, mid-season, large, bright red, nearly smooth, productive. Good.

Bird, early, small, dark red, smooth, very productive.

Brandywine, mid-season. medium to large. red. smooth.

Bright and Early, early medium, small, bright red, little rough.

Brintons Best, mid-season. medium size. red. usually smooth. firm and solid.

Buckeye State, mid-season. medium to large, purple, somewhat rough.

Combination, mid-season, large, rough. bright red, heavy yielder.

Cream City, mid-season, medium to large, purple. little rough.

Crimson Cushion, medium to late. large, purple, smooth. very desirable.

Crimson Robe, mid-season. large, purple, little rough.

Cumberland Red, mid-season, large to very large, red, rough.

Daybreak, mid-season, medium size, red, rough.

Democrat, mid-season, medium size. purple, nearly smooth. desirable.

Dominion Day, mid-season. medium to large, red, nearly smooth, excellent.

Dwarf Aristocrat, mid-season, medium size. red, little rough.

Dwarf Champion. early to medium, large, solid, purple, smooth, choice.

Earliana, extra early, small, red, little rough, choice, early

Enormous, medium to late. very large, red, rather rough, coarse.

Excelsior, mid-season, medium size, purple, smooth, attractive.

Favorite, mid-season, large, purple, smooth, firm, good shipper.

Fordhook. mid-season, medium size, purple, smooth, attractive.

Freedom, early, small to medium, regular, scarlet, little rough.

Frogmore, mid-season. medium size, purple, smooth, pulpy.

Great Mississippi, medium, large. red, rough, coarse, productive.

Ignotum, early medium, large, red, smooth, choice quality.

Ignotum Potato Leaf, mid-season, medium to large, purple, smooth, excellent.

Long Island, mid-season, large, red, smooth, very productive.

Long Keeper, late. medium to large. purple, little rough.

Lorillard, early to mid-season, small to medium, red, smooth, choice for forcing.

Magnus, late, large, red, rather rough, very productive.

Mayflower, early medium, small, red, rough, very productive.

Minnesota, extra early, small, purple, smooth, a choice extra early.

Money Maker, mid-season, medium, red, rough.

New Imperial, mid-season, large, purple, smooth, very choice.

Northern Light, early, medium size, red, smooth, productive.

Optimus, mid-season, large, red, smooth, valuable.

Perfection, early, medium size, purple, smooth, regular, productive.

Ponderosa, late, very large, purple, smooth to rough, valuable.

Ponderosa Early, early, large, purple, smooth. A choice selected strain.

Quarter Century, mid-season, large, purple, smooth, desirable.

Quicksure, extra early, large, red, rough, very productive.

Red Granite, mid-season, medium size, purple, little rough.

Richmond, early to medium, small, red, rather rough.

Rosalind, mid-season, medium size, purple, usually smooth, solid, desirable.

Royal Red, mid-season, large, red, little rough, very productive, choice quality.

Ruby, early, small to medium, red, smooth, fine quality.

Shippers Delight, late, large, purple, little rough, desirable.

Stone, mid-season, medium size, red, smooth, solid, very desirable.

Ten Ton, mid-season, medium to large, red, smooth, of some value.

Thorburn Novelty, mid-season, large, round, red, rather rough.

Trophy, mid-season, large, dark red, smooth, solid, standard.

Truckers Favorite, mid-season, large, oval, smooth, red, solid, choice.

Twentieth Century, mid-summer, large, purple, little rough.

PRESERVING AND PICKLING SORTS.

Clusterosa, mid-season, small, yellow, pear shaped.

Egyptian Yellow, mid-season, medium size, yellow, rough.

Golden Prize, mid-season, medium size, yellow, smooth, one of the best.

Lemon Blush, mid-season, medium size, yellow, smooth, desirable.

Sumatra Egg, mid-season, small, yellow, rough.

White Apple, mid-season, small, white, smooth.

Yellow Pear, mid-season, small, yellow, smooth.

Yellow Peach, mid-season, small, yellow, rough.

NEW VARIETIES.

Boston Market, from R. and J. Farquhar and Co., is a very popular variety with eastern truck gardeners. It is very productive and medium early. The fruit is large, bright red, slightly corrugated about the stem, but smooth at the apex. It is solid, firm, and of excellent flavor.

Buckeye, from Landreth, is a large, smooth, red variety of good quality. It is very productive and seems to be identical with Livingston's Buckeye State, received from Vick's Sons. It is a very showy variety and is solid and smooth for so large a sort.

Burbank Preserving, received from Burpee, is a very small upright growing variety. The fruits grow in clusters like currants and are especially valuable for preserves.

Cardinal, from Salzer, is a spreading variety of great productiveness. The fruit is of a desirable size, bright red, firm and of good flavor.

Challenge, received from Mills, seemed to lack in productiveness, although the excessive growth of vines might be due to the wet season. The fruits were fairly smooth, bright red, and a little soft. In a dry season, the quality would probably be much improved.

Climax, from Burpee, is a medium-early purple variety of choice quality.

The vines are of moderate growth but carry a good amount of fruit. A choice sort for its season.

Crimson Whirlwind, from Salzer, is a very large red variety. The vines are strong and vigorous, but the fruit failed to properly ripen this season, or to develop any promising characteristics. It seemed to be rather rough.

Duke of York, from Bolgiano & Son, has vines averaging five feet in length with a spreading habit, which were loaded with fruit. The tomatoes are a bright, dark red color nearly purple, rather rough at the stem, but smooth otherwise. They averaged 6.25 ounces in weight and were firm and of fine flavor. Apparently rather late.

Dwarf Scarlet Champion, from Vaughan, seemed to be a selected strain of Dwarf Champion. They are attractive, productive and of good quality.

Early Leader, from Vick's Sons, is a quick maturing productive variety, but the fruit is too rough to be desirable. It is very similar to Vaughan's Earliest.

Early Tree, from the Great Northern Seed Co., is a dwarf variety. The fruits are regular, slightly seamed, red, and of good flavor.

Eclipse, from Weeber & Don, is a quick maturing, red variety of high quality. The vines have a spreading habit and average about four feet in length. The fruits average 4.18 ounces in weight, and are attractive in color and their smoothness and quality make them a most desirable early sort. They are said to be especially valuable for forcing.

Essex, from Farquhar & Co., is an early variety of some value, but it is not equal to the Eclipse. The fruits are bright red and fairly smooth.

Eureka, from Holmes, is an early, red, smooth variety, nearly identical with Essex. They resemble Ruby.

Fifty Day, from Salzer, is a dwarf, purple, smooth variety and it is nearly identical with Early Minnesota.

Futurity, **Giant Everbearing** and **Illinois**, were all received from the Great Northern Seed Co. **Futurity** is a large, red, smooth variety of good quality. It is much like **Trophy**. **Giant Everbearing** is an extra large, red variety, rather rough and coarse, and too soft to be of much value. **Illinois** is a medium-sized, purple, smooth variety that is both attractive and desirable.

Large Early and **Matchless** were received from W. A. Burpee & Co. **Large Early** is truly a large, early maturing, purple sort. The vines are vigorous and productive. The fruit is smooth and attractive but rather soft. This fault may be due partially to the wet season. **Matchless** is a bright red variety that is much liked in some sections. They are productive, smooth, solid and meaty, and ripen well through the season, beginning with the second early kinds.

Marvel and Table Queen were from Dreer. Marvel is a smooth, red variety of good quality. Table Queen is purple and is inclined to be a little rough about the stem, but the flesh is firm, solid, meat has a pleasant flavor. They are both strong growers and quite productive.

Melrose, and Waldorf were received from Holmes. Melrose is a quick growing and early maturing purple variety. The fruits are smooth and of good quality, but not numerous. Waldorf is very similar, except that the color is more of a rose tint and the season is a little later. It is more productive and the quality is about the same.

Michigan, from Ferry, is a choice second early variety. It is productive, smooth, meaty, of good flavor and has an attractive bright red color. Very desirable.

Model, from Vaughan, is an extra early bright red variety. The vines have an upright, but dwarf habit. They averaged only about two feet in height and were well loaded with fruit, of good quality. The plants can be set much closer than many other varieties.

Morning Star and Perfect Gem, were from Salzer. They are red varieties of some merit. Morning Star is a very large and rough late sort. Perfect Gem is of medium size, smooth, meaty and of good quality.

New Glory, Redfield Beauty, and Wealthy were received from Bolgiano and Son. New Glory is a very large red variety but it did not become fully ripe. Redfield Beauty seems to be a selected strain of Beauty. Wealthy was one of the earliest varieties in the test. Some of the fruit was a little rough, but the bulk of it was round, solid, and meaty. It has a bright red color, and is of good quality. The vines were about forty-two inches long, stout and with spreading habit. Not very productive.

Niagara, introduced by John A. Bruce and Co., Hamilton, Canada, is a smooth, medium to large bright red variety; texture firm and meaty. The quality is good and its firmness makes it a good handler. The vines are thrifty and very productive.

Nolte's Earliest, also from Ferry, seems to be quite a choice early variety. Many of the fruits failed to properly ripen but the plants are vigorous growers and productive. The fruit is rather small, slightly rough at the stem, but solid and meaty.

Peachblow and President Cleveland were received from Farquhar. Peachblow. (Suttons), is a small, smooth purple variety. It is very productive and of good quality for its size, but it is too small for commercial use. President Cleveland is a slightly rough red variety. The vines are large coarse growers, and were loaded with large tomatoes, but they failed to fully ripen.

Princess, from Livingston Sons has a smooth, purple fruit with foliage of the Potato leaf type but is of no especial value.

Prizewinner and Queen were received from Griffith and Turner, Baltimore, Md. They are red varieties and are quite similar except in size, Prizewinner being the larger. They are productive and of good quality.

Early Jersey, from Landreth, is an extra early rather rough, red variety. The vines are very vigorous and productive.

Volunteer from Rawson, resembles Ruby except that it is larger. The vines are medium strong growers and productive.

Golden Dome and Golden Queen are two of the most desirable yellow sorts. They are smooth, solid, meaty, of pleasant flavor and excellent for preserves.

Some of the seeds for the variety tests were received from the Department of Agriculture, Washington, D. C., others were saved by this department but most of them were obtained from the following seedsmen:

J. Bolgiano and Sons, Baltimore, Md.
John A. Bruce and Co., Hamilton, Canada.
W. Atlee Burpee and Co., Philadelphia, Pa.
John Lewis Childs, Floral Park, N. Y.
Currie Bros., Milwaukee, Wis.
Henry A. Dreer, Philadelphia, Pa.
Wm. Elliott and Sons, New York, N. Y.
J. A. Everitt, Indianapolis, Ind.
Farmer Seed Co., Faribault, Minn.
R. and J. Farquhar and Co., Boston, Mass.
D. M. Ferry, Detroit, Mich.
Ford Seed Co., Ravenna, Ohio.
Germaine Seed and Plant Co., Los Angeles, Cal.
Jas. J. H. Gregory, Marblehead, Mass.
Griffith and Turner Co., Baltimore, Md.
Joseph Harris Co., Moreton Farm, N. Y.
Peter Henderson and Co., New York, N. Y.
D. L. Holmes, Harrisburg, Pa.
Iowa Seed Co., Des Moines, Iowa.
D. Landreth and Sons, Philadelphia, Pa.
Livingston Seed Co., Columbus, Ohio.
Wm. Henry Maule, Philadelphia, Pa.
F. B. Mills, Rose Hill, N. Y.
Northrup, King and Co., Minneapolis, Minn.
W. W. Rawson and Co., Boston, Mass.
Wm. Rennie, Toronto, Canada.
John A. Salzer Seed Co., LaCrosse, Wis.
J. M. Thorburn and Co., New York, N. Y.
J. C. Vaughan, Chicago, Ill.
James Vicks Sons, Rochester, N. Y.
Weeber & Don, New York, N. Y.
T. W. Wood and Sons, Richmond, Va.

BUSH FRUITS.

RASPBERRIES, 1902.

For the lack of a desirable location, the experimental varieties have been reduced until the list includes only a few of the better sorts. In the spring of 1901 a new plantation was set which will be reported as they come to fruiting maturity.

BLACK VARIETIES.

Coloma, produced a small amount of fruit for the first time. The canes are of fair growth. The berries are jet black, medium size and of good quality. Further trial is necessary to determine its real value. It is a mid-season thornless variety received from John Wenslick, Coloma, Michigan.

Cumberland is one of the most desirable varieties of recent introduction. The plants are very vigorous, healthy growers and seem to be very hardy. The fruit is a bright, black color, good size and has a sweet pleasant flavor. They average about eleven to the ounce in weight. The first fruit ripened July 2 and the last July 30, holding their size and quality well through the entire season.

Eureka is a desirable early sort. Ripened June 20. The canes are thrifty and healthy. In productiveness they rank well. The berries are medium to large, round, a little conical, pulpy and have a pleasant flavor. Averaged sixteen to the ounce.

Gregg is the most popular black-cap grown and suits itself to almost any conditions. With good culture, there are few superiors. The canes are strong, productive, and fairly hardy; berries attractive and of choice quality. Twelve to the ounce.

Kansas is a very productive variety largely grown for commercial purposes. The berries are of good quality and medium size. Averaged sixteen to the ounce. Ripened June 28 to July 26.

Lotta seems to be very susceptible to the rust and anthracnose. The berries are of good quality but the canes lack vigor.

Ohio. The canes are quite strong and healthy in growth and bear heavily. The berries are rather small, bright black, round, pulpy and of pleasant flavor. The period of ripening was June 29 to July 20. Averaged 30 to the ounce. Valuable for evaporating.

Pride of Ohio. It is not as productive as some of the other varieties but the berries are of a solid black color, firm and desirable. The canes are hardy, strong growers. Fruiting period July 6 to 24. Averaged 20 to the ounce.

Livingston produced medium-sized berries of fair quality. The canes are strong growers and productive.

Palmer. The berries average too small to be popular, ranking 29 to the ounce. The canes are spindling but seem healthy.

PURPLE.

Shaffer is the leading variety of this class. The canes are thrifty and productive. Berries loose and of medium quality.

Columbian is of better color and less subject to anthracnose.

RED VARIETIES.

Eaton received from Amos Garretson, Pendleton, Indiana. The canes are hardy, strong growers; fruit, dark red, oval, medium size and has a tendency to rattle some. The quality is not up to the Loudon or Cuthbert.

Harris. The fruit is of poor quality, and the canes have a short, stocky habit. The berries are of medium size, bright red, coarse, and crumble badly. The flavor is flat and insipid.

Loudon ranks as one of the standard red varieties. The canes are usually thrifty, and productive. This and the Cuthbert are two of the best red varieties.

Ridgeway was received from W. H. Ridgeway, Wabash, Indiana. The canes are very strong and thrifty growers, but the berries are few in number and small. The flavor and texture is good.

Gold, a yellow variety, was received from the same party. The canes are good growers and the berries are good for their class but there is no place on the market for them, the popular demand being for black or red berries.

Muskberry, a novelty, sent out by John Lewis Childs of Floral Park, N. Y., fruited for the first time this year. The canes are extremely rank growers, reaching eight to ten feet in height. They spread very badly from the roots and, like the strawberry-raspberry, are a decided nuisance in a garden. The fruit is of good size and attractive in appearance but the flavor is insipid and disagreeable. The bushes throw off a musky odor.

BLACKBERRIES.

The soil and location here is such that it is impossible to grow blackberries with any degree of success.

Rathbun, Mercereau, Hess and other improved varieties have been tried several times but they winter-kill every year.

Early Harvest seems to thrive as well as any variety and is very productive. The berries are of medium size and have a very small core. The flavor is pleasant.

Snyder and Taylor are two standard varieties that usually produce fruit of good quality in any section where blackberries can be grown.

CURRANTS.

In 1897 and 1898 several of the newer varieties of currants were planted, which have reached maturity from a fruiting standpoint.

Eclipse, received from H. S. Anderson, Elizabeth, New Jersey, has strong, vigorous, healthy bushes. The stalks are upright, stout, and

thickly covered with large leaves. The fruit stems are long and well-filled, containing 12-16 rather small dark-red fruits which have a slightly heavy, rich juice. The berries are rather small for fancy use but the quality is fine for jellies and they are very productive.

Empire, received from J. Lewis Childs, Floral Park, N. Y., seems to lack in hardiness as the bushes winter-kill some and do not recuperate readily. The berries are large, of a bright dark or ruby red, but the stems are short and contain only a few berries. The berries are of good quality and attractive but they are not productive enough to be profitable.

Filler, received from Jos. H. Black & Son, Hightstown, N. J. Originated in Ulster Co., N. Y. The bushes are very coarse, upright growers, with dark rank foliage. The clusters are of medium size, long, well-filled with bright red currants. They are good size, attractive and have a pleasant rich flavor.

London Market, received from Alexander Hamilton, Bangor, Michigan, is a promising variety for general cultivation. The berries are a little larger than the Pomona and have a bright clear red color. The juice is thick, heavy and of a pleasant sprightly flavor. The bushes are thrifty and vigorous but not quite as productive as Pomona.

Pomona, received from Albertson & Hobbs, Bridgeport, Ind. This has proven to be one of the best varieties of recent introduction. It is a vigorous thrifty grower and exceedingly productive. The clusters are long and filled with medium-sized berries having a mild, rich, pleasant flavor. The color of the fruit is a bright, clear red, becoming dark when fully ripened. They adhere firmly to the stems which prevents their massing in the boxes.

Purity, received from John Lewis Childs, Floral Park, N. Y. The bushes are low-growing and have a sprawling habit. The fruit is a yellowish white, but it is not equal to the White Transparent in quality or productiveness.

Red Cross, from Green's Nursery Co., Rochester, is another choice variety. The bushes are more upright and coarser than Pomona but not quite as productive. The berries are a little darker in color, and a trifle larger than Pomona but the stems are long and loosely filled. The quality is excellent.

Scarlet Gem is not what the name would signify, it being a pinkish-white currant. The bushes are low growers, coarse, and sparsely covered with foliage; stems long, fairly well filled with small, sub-acid, pleasant flavored berries.

White Transparent, received from Geo. S. Josselyn, Fredonia, N. Y., and White Versailles from John Charlton & Sons, Rochester, N. Y., are two choice white sorts resembling each other. The berries are about the same size and have a rich thick juice of a desirable sprightly flavor. The bushes are upright, strong growers and well loaded with fruit. The Transparent bunches are not quite as long as the Versailles but are a little more compact, which makes the productiveness about the same. The Versailles berries are a trifle larger but in general they are two varieties either of which could be selected as a choice white currant.

Wilder was received from Isaac Rogers, Dansville, N. Y., and is a seedling of Versailles. The berries are a little larger than Fays Prolific and of superior quality. The bushes are thrifty and productive. It is a valuable variety.

GOOSEBERRIES.

In 1902, both the American and English varieties gave a good crop of fruit. The season was very wet and by spraying the English varieties with Bordeaux mixture early in the season, and following later with frequent sprayings of liver of sulphur (1 ounce to 3 gallons of water) the mildew was held in check so that the fruit was not seriously injured.

THE AMERICAN VARIETIES.

Downing for a green-colored berry is the most generally grown. It is hardy, of choice quality and over-productive. Some of the later varieties are larger but inferior in quality and can only be grown with the utmost care and attention. This is especially true of the English sorts.

Pearl and Red Jacket are two of the best newer sorts of the American varieties. They are thrifty, productive and of good quality.

Among the English varieties we have Chautauqua, Columbus, Industry, Keepsake and Lancashire. They have made medium to good growths but it is only by careful handling and weekly sprayings that we can mature the fruit. This is large, of choice quality, attractive but unless a grower has access to some good market, they are not profitable.

A new plantation was put out in 1901, including the best of the newer varieties and reports will be made on their behavior later.

Agricultural College, Michigan, February 21, 1903.

FERTILIZER ANALYSES.

FLOYD W. ROBISON.

Bulletin No. 210.

The sole use of commercial fertilizers is to supply the soil with food available to the growing plants. This object can also be attained by rendering more available the natural resources of the soil or by returning to the soil the natural manures produced on the farm. To each farmer comes the question whether he can afford to use commercial fertilizers. His first thought should be as to the natural resources of his soil. If his soil has an abundance of the fertilizing ingredients, it is not economy and is manifestly *poor farming* to add material which can be of no use, and may be of some harm and which, being subject to the leaching action of rain, is speedily lost. He should resort to commercial fertilizers only when the natural manures on his farm *fail* to supply the desired fertilizing ingredients. It is not economy to pay for fertilizing materials which the soil or the farm manure pile may themselves yield; but it is economy to use commercial fertilizers when the soil and the natural farm manures *fail* to return the equivalent of what is removed by the farm crops. It is not economy to supply fertilizers indiscriminately because they are called fertilizers, and many times in our own State has the righteous cause of the artificial fertilization of the soil been repudiated simply because the farmer who "tried it" did not take the pains to ascertain if the particular fertilizer he was using was the one adapted to his land. One could not expect to receive good returns for his investment if he applied a nitrogenous fertilizer to a soil already rich in nitrogen, nor could he expect a soil that had been liberally dressed with wood ashes for years to be much benefited by an application of a fertilizer high in potash. *A fertilizer containing a high percentage of potash is needed on that soil in which potash is deficient.* A consideration of the proper kind of fertilizer to be used depends also on the crop to be raised, for plants differ widely with respect to the particular ingredients upon which they draw heaviest in the soil.

AVAILABILITY OF FERTILIZERS.

In selecting a fertilizer two things should be kept in mind: first, the *total* amount of nitrogen, phosphoric acid and potash present, and second, the amount of nitrogen, phosphoric acid and potash *available*. Farmers always will seek and it is right that they should an immediate effect of the fertilizer used. With a soil that is *normal* in fertilizing constituents all that is necessary is to add in fertilizing material each year

the equivalents of what is removed by the crop. Such a soil requires a fertilizer whose constituents are all available, that is, ready for immediate use. Such a fertilizer would have its nitrogen in the form of nitrate of soda, or sulphate of ammonia, its phosphoric acid would be in the form of dissolved rock or dissolved bone, and its potash would be in the form of sulphate, muriate or carbonate. In this case, to supply the immediate needs of the growing crops should be the direct object of the use of fertilizers. In a soil *below the normal* in fertilizing constituents not only should the fertilizing requirements of the crop receive attention, *but the soil should be fed as well.* The building of the soil is accomplished by the application of fertilizers less readily available. Such fertilizers would have their nitrogen in the form of blood, tankage, cotton seed meal, bone meal, or digested leather. Their phosphoric acid would be in the form of raw bone meal, steamed bone meal or South Carolina rock. The availability of potash need not be a matter of concern for in most fertilizers it is equally available.

HUMUS.

All productive soils contain a considerable amount of organic matter, usually termed humus. An abundance of humus portrays a healthy condition of the soil, as far as the nitrogen supply is concerned. The supply of humus is kept up in two ways: first, by rotation with leguminous crops and green manuring. Second, by the liberal application of barnyard manure. Farmers do not yet sufficiently realize the extent to which they impoverish their land by a failure to return in barnyard manure the *organic* equivalent of what is removed by the crop. Commercial fertilizers will be used in vain, if the humic condition of the soil is not constantly replenished. *To better secure this end* it is well to consider commercial fertilizers as supplementary to the barnyard manure and in most instances they should be used in connection therewith.

THE ESSENTIAL PLANT REQUIREMENTS.

There have been proven to be thirteen elements more or less essential to plant growth. Of these, however, the agriculturists need be concerned for but three, namely, nitrogen, phosphoric acid and potash. All of the others are present in nearly all soils to a sufficient extent to satisfy the needs of vegetation. Just why and in what way these three ingredients are so essential is not known. What is known is that vegetation cannot exist in the absence of any one of the three. This suffices to explain the need of fertilizers: We are not as yet able to feed the plant, so to speak, we can but furnish the raw materials and the plant must do its own arranging and assimilating. Inasmuch as plants will not grow in the absence of available nitrogen, phosphoric acid and potash we know that these materials are essential. We then in commercial fertilizers furnish these three materials to the plant. It does its own arranging and building into such complex nitrogenous substances as "gluten."

NITROGEN.

Nitrogen is the element usually least abundant in soils and is the element most readily exhausted. It is also the most costly element to supply to the soil. Four-fifths of the volume of the atmosphere consists of nitrogen, but to most plants this enormous supply is of no consequence for they are entirely unable to assimilate it. A few plants belonging to the clover class are enabled, because of the small nodules on their roots, to change some of the atmospheric nitrogen into forms which can be utilized by the growing plant. This fact partly explains why a soil impoverished, from a nitrogen standpoint, is so benefited by turning under a heavy crop of clover as a green manure. Nitrogen is at the two extremes of nature. It is nitrogen that is so sluggish and inactive that it has been named "Azote, without life." Nitrogen does not support combustion, for if a flame is put into a jar containing nitrogen alone, the flame is at once extinguished. It is this same formerly inactive nitrogen, however, the various combinations of which form the deadliest explosives known. It is the compound of nitrogen that form some of the deadliest poisons known. It is nitrogen that makes nitroglycerin and dynamite such powerful and destructive agents. It is nitrogen that makes prussic acid one of the most deadly poisons known to man. It is this same nitrogen, another of whose combinations, is such an all-essential element of animal food *Protein*, or the albumen in eggs, the gluten in flour, the fibrin in meat, and the casein in milk, is the most essential constituent of animal food, and it is one of the various combinations of nitrogen. These considerations may serve to show in part why nitrogen is so essential and it is no wonder that its presence in the soil is of such vital interest to vegetable life. Nitrogen is found in fertilizers as *organic nitrogen* and as *salts of ammonia and nitric acid*. As organic nitrogen it is present in the scraps of meat, blood, vegetable matter, or leather; as a salt of ammonia it is present, chiefly, as ammonium sulphate. As a salt of nitric acid, it is present, chiefly, as nitrate of soda or Chili saltpeter. Nitrogen in the form of ammonium salts and nitric acid salts is the most readily available. Organic nitrogen must be disintegrated by agents in the soil before it can be made available to the plant. There are, however, differences in the availability of organic nitrogen from different sources. Nitrogen from blood, or seed meals, is much more readily available than is the nitrogen in leather and tankage made from garbage materials.

PHOSPHORIC ACID.

Phosphorus in plants and fertilizers is usually expressed in the form of phosphoric acid (P_2O_5). Phosphorus by itself is very inflammable and is also a deadly poison. When united with oxygen to form phosphoric acid it is not only harmless but essential to plant growth. It is usually found in fertilizers in combination with lime or it may be as free phosphoric acid in super-phosphate fertilizers. Phosphoric acid is recognized in fertilizers in three forms:

1. *Water-soluble phosphoric acid* gives us phosphoric acid in the free form as in true super-phosphates and as mono-calcic phosphate in which forms it is readily soluble in water.

2. *Citrate soluble phosphoric acid* gives us phosphoric acid in the form

of what is commonly called reverted phosphoric acid. By reverted phosphoric acid is meant chemically di-calcic phosphate. This form is supposed to have been once soluble in water but after standing some time to have *reverted* or *gone back* to the di-calcic phosphate, hence its name, reverted phosphoric acid. This reverted or di-calcic phosphate is completely soluble in a solution of citrate of ammonia, hence its name, also, citrate-soluble phosphoric acid. In this form it is supposed to be readily available to plant growth and, therefore, in the Bulletin the water soluble and the citrate soluble are taken together and called "available phosphoric acid."

3. *Insoluble phosphoric acid.* In this form the phosphoric acid is as tri-calcic and tetra-calcic phosphate of lime and is completely insoluble in water and citrate of ammonia. It is not, therefore, immediately available to plants. Fertilizers containing their phosphoric acid in this condition should not be used where immediate results are expected, but they may be used to reclaim exhausted soils.

Generally speaking, the fertilizer of most value from a phosphoric acid standpoint is the one containing a relatively large proportion of available and a relatively small proportion of insoluble phosphoric acid.

SUPER-PHOSPHATES.

In true super-phosphates the phosphoric acid is all available. Super-phosphates are formed by treating insoluble bone and phosphate rock with sulphuric acid. The sulphuric acid combines with the lime forming sulphate of lime or gypsum, while the phosphoric acid being freed from its combination with the lime is rendered available. Super-phosphates are known in fertilizers also as acid phosphates.

POTASH.

Potash (K_2O) is a combination of the metal potassium (K) two parts with one part of the gas oxygen (O). Potassium in the free state is not known in nature for it has such an affinity for oxygen that it will destroy other substances to obtain their supply of oxygen. In contact with water it takes fire, thus decomposing the water and depriving it of its oxygen; it, like phosphorus, is not estimated in its pure state, but as potash.

Potash is a constituent of many rocks and in organic forms in vegetables it is quite abundant. Roots contain a large amount of potash. It is available to commerce, mainly in the forms of sulphate and muriate of potash. Wood ashes contain considerable amounts of potash (about 5%) in the form of carbonate of potash. Only one form of potash is recognized in fertilizers, and that is what is soluble in water.

USES OF NITROGEN.

1. Nitrogen gives a healthy growth to plants by promoting the formation of chlorophyll, or the green coloring matter of the stems and leaves.

2. It is useful in promoting leaf growth but if present in too large available quantities it retards maturing of the plant.

USES OF PHOSPHORIC ACID.

1. Phosphoric acid is useful in promoting seed formation and early maturity. In this respect it works antagonistic to nitrogen.

2. It promotes the formation of proteid material and is thus essential to plant nutrition.

USES OF POTASH.

1. Potash seems to play an important part in sugar formation by aiding in the transference of starches in plants. It is abundant in the sugar beet but excessive amounts are detrimental to the artificial recovery of sugar from the plant, because it prevents crystallization of the sugar.

2. It is essential to the development of the fleshy fruits and is important in the formation of the woody structure of the plant.

VALUATION OF FERTILIZERS.

The following prices may be used as representing quite closely the retail cost per pound of the ordinary forms of nitrogen, phosphoric acid and potash in chemicals and raw materials:

	Per pound.
Nitrogen in nitrates	\$0 15
Nitrogen in ammonia salts.....	17½
Nitrogen in organic matter.....	17
Phosphoric acid, available.....	04
Phosphoric acid, insoluble.....	02½
Potash as muriate.....	04½
Potash as sulphate	05
Potash as carbonate	05

The above valuations refer to the commercial value and not to the agricultural value of fertilizers. They simply refer to the market cost of the ingredients in the various forms as found in our large markets and as subject to market law of supply and demand. The agricultural value is quite a different thing and is a matter of variation on different farms.

CONCERNING GUARANTIES.

Farmers should note carefully that the maintenance of a guaranty has nothing whatsoever to do with the excellence of the fertilizer. It simply means that the manufacturer has set a standard and the Station has found the goods up to his mark. The law simply requires the manufacturer to guarantee the composition of his goods and he has complied with the law when these requirements are met. The maintenance of a guaranty is, therefore, not a proof of the value of the goods but simply shows that the manufacturer meets his claim.

SUPERFLUOUS GUARANTIES.

The law requires the manufacturer to print on the outside of the sack the guaranteed analysis of the fertilizer. Beyond this point the law is silent. It does not say what price shall be asked, neither does it place any limit on the guaranty. As a consequence manufacturers have in

some instances covered nearly the whole front of the sack with guaranties, which cannot help being confusing and misleading. Below is printed an example of such a guaranty.

Nitrogen, 2 to 3%.
Nitrogen as ammonia, 2.43 to 3.6%
Moisture at 212 degrees F., 5 to 10%.
Reverted phosphoric acid, 2 to 6%.
Water soluble phosphoric acid, 6 to 8%.
Available phosphoric acid, 10 to 12%.
Total phosphoric acid, 12 to 14%.
Insoluble phosphoric acid, 0 to 2%.
Bone phosphate of lime, 24 to 27%.
Potash 2 to 3%.
Potash as sulphate, 3.7 to 5.5%.

* The above reduced to its simplest form would be:

Nitrogen, 2%.
Available phosphoric acid, 10%.
Insoluble phosphoric acid, 2%.
Potash, 2%.

It seems hardly probable that manufacturers would go to the trouble of printing such a long array of guaranties if it were not advantageous for them to do so, and it is very probable that if two sacks were offered for sale one showing the first guaranty and the other showing the second, a great number of farmers would select the brand with the longer guaranty. The wants of the farmer would be *best* provided for if manufacturers would tabulate their guaranties in the simplest possible form. The Station will firmly endorse such a procedure.

Farmers should take notice also that the common way of expressing the guaranty as nitrogen 2 to 3% is a guaranty of but 2% nitrogen. Phosphoric acid 10 to 12% guarantees but 10% of phosphoric acid. The upper figure is of no import unless it be to signify a desire on the part of the manufacturer to claim more than he is willing to be responsible for.

TRADE NAMES.

Trade names, in so far as they designate the particular crop for which the fertilizer is to be used are misleading. Trade names should designate the material from which the goods are manufactured and not the crops for which they are to be used. Some fertilizers designated according to names as specially for one crop are frequently found under a different name and advertised as a special manure for some entirely different crop. The fact that they are sold for what they are named simply proves that farmers look at the trade name instead of the analysis. There can *properly* be no such thing as special fertilizers for a particular crop. The needs of a crop depend upon the conditions of the soil in which they are grown. A fertilizer made especially for sugar beets on one farm may and in all probability will not be applicable to sugar beets grown on a different farm. What is needed is fertilizers showing varying amounts of the essential ingredients and graded accordingly. The farmer can then select that one which best conforms to his particular needs.

THE HOME MIXING OF FERTILIZERS.

In some states and by those farmers who have carefully studied the matter, home mixing of fertilizers has been highly successful. Home mixing is especially desirable where a special fertilizer is needed and one giving the desired composition is not offered for sale. With proper care farmers can make mixtures that meet their requirements by buying the raw materials and mixing them on the barn floor at home. This is commendable because it necessitates a study of soil conditions at home and thus the farmer puts on the land the exact fertilizer needed. It is not to be expected that such a fertilizer will be as thoroughly mixed as factory goods but it will be found sufficiently satisfactory and usually much cheaper.

THE MICHIGAN FERTILIZER LAW.

(Act No. 26 of the Session Laws of 1885.)

SECTION 1. *The People of the State of Michigan enact*, That any person or persons who shall sell or offer for sale in this State any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certificate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer; the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in available form; of potash soluble in water and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

SEC. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer or party who causes it to be sold or offered for sale within this State, shall file with the secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar, containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

SEC. 3. The manufacturer, importer, or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this State: *Provided*, That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

SEC. 4. All such analyses of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

SEC. 5. The secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analyses made and certificates filed in his office; together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees

remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

SEC. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this State without first complying with the provisions of sections, one, two, and three of this act, or who shall attach or cause to be attached to any such package or fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain shall, upon conviction thereof, be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

SEC. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this State, a quantity not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

SEC. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

The attention of manufacturers is called to Section 2 of the above law which requires to be filed with the secretary of the State Board of Agriculture a copy of analysis and certificate and also a sealed sample of the fertilizer *before such fertilizer is sold or offered for sale.*

Section 3 provides that on or before May 1st of each year the license fee shall also be deposited with the secretary. It is of mutual interest to the farmer and manufacturer that the Bulletin be published in time for the fall trade in fertilizers.

CHEMICALS.

All chemicals that are applied to the soil, such as sulphate of potash, muriate of potash, kainit, sulphate of ammonia, nitrate of soda or nitrate of potash, are considered as coming under the head of commercial fertilizers and as such are subject to the same conditions as other fertilizers. The object of the law is the protection of the farmers and this cannot be given unless the entire field is covered. Dealers in these chemicals should see that they are properly labeled and licensed.

LEGAL GOODS.

The fertilizers, the analyses of which appear in this Bulletin, are the only fertilizers that can be lawfully sold in this State. Farmers and the granges should co-operate with the Station in securing evidence and samples of goods unlawfully on sale and by so doing the fertilizer law will fulfill the object for which it was intended; that is, the protection of the farmers.

Dealers in handling fertilizers should see that goods offered for sale bear the required license. If goods are offered for sale the analysis of

which does not appear in the Bulletin an inquiry addressed to this division will secure prompt reply as to whether the goods can legally be sold.

It is a pleasure to acknowledge herewith the able and conscientious assistance of Mr. Lyman Carrier, B. Sc., who has aided much in the work of both inspection and analysis.

The following are the names of parties visited on the annual inspection for 1903:

- Adair*—Martin Blank, C. H. Lipke.
Allegan—B. F. Foster, Schuler & Born.
Almont—Hart & Sullivan, Frank Bishop.
Bay City—Jenison Hardware Co., R. C. Bialy, Presley & Layer, F. C. Goodine.
West Bay City—Geo. L. Frank, Geo. L. Mosher, Mohr Hardware Co.
Ann Arbor—John Heinzman.
Benton Harbor—H. E. Boehn, B. M. Nowlen & Co.
Berrien Springs—F. P. Ford.
Bad Axe—Lankin & Dundas, Wright, Freemont & Co., Harris Hardware Co., William Rapson & Sons, W. H. Carey & Co.
Birmingham—W. I. McClelland.
Brighton—A. C. Stewart, H. F. Hyne.
Buchanan—Pierce & Sanders.
Clio—Kent & Doyle & Fred Houghton, J. Wellman & Sons, G. W. Hubbard & Co.
Cassopolis—H. E. Moon, J. F. Hayden.
Chelsea—J. F. Barth, E. S. Spaulding, R. A. Snyder.
Constantine—Hutton & Barnard.
Coldwater—Randolph Bros., S. I. Treat & Son.
Corunna—Green & Pettibone.
Carsonville—Hartshorn & Anderson, C. J. Walker, H. Baird.
Coloma—Peck Bros., Stratton & Blackman.
Dundee—W. S. Wells.
Discoe—J. W. Switzer.
Dearborn—S. Baldwin.
Dowagiac—Edwin Corwin, F. H. Reshore.
Detroit—T. Feldman & Sons.
Flint—F. J. Hall & Co., Edwards Bros., R. Putnam & Co., E. A. Jennings, Moffett & Skinner.
Flushing—W. W. Mutton, Ottawa & Co., D. B. French.
Fennville—Geo. B. Meechem.
Grand Rapids—A. J. Brown Seed Co., Jones Seed Co., Perkins, Hess & Thompson.
Grand Haven—James Locke, Geo. Hancock & Sons.
Galesburg—Blake & Thomas.
Goodrich—Geo. Liscom.
Howell—W. L. Knapp & Son, Douglas Marr, Fred P. Schroeder, Asa Parshall.
Hart—H. P. Gephart.
Hartford—E. D. Goodwin.
Half Way—Frank P. Gerlach.
Hillsdale—Frank Whitney, G. N. Smith.
Holly—McLaughlin Bros., T. P. Morgan, M. F. Chase.

- Ionia*—Spaulding & Merritt.
Ida—Weipert & Couisno, Silas Kring.
Imlay City—Milo Quirk, J. W. Green, C. S. Marshall.
Jackson—S. M. Isbel & Co., Reid Implement & Seed Co., J. E. Bartlett.
Kalamazoo—Geo. W. Parker, S. D. Detmers, Woodhams Coal Co.
Kinde—J. H. Hall & Son, Wallace & Co.
Lenox—J. W. Patterson, Farmers Elevator Co., Richmond Elevator Co.
Linden—T. J. Winget & Sons, A. H. Buck & Sons, Judson Bros.
Lansing—C. Fitzsimmons, F. G. Dunning.
Laingsburg—C. D. Sharp, F. S. Lockwood & Co.
Lapeer—H. J. Willitt, Robert King, E. C. Roberts.
Marine City—Zimmerman Bros., H. H. Schneider.
Mt. Clemens—L. Houghton, John N. Tucker.
Marshall—H. J. Coleman.
Monroe—G. R. Hurd Sons Co.
Mt. Morris—J. H. Lewis, J. Lafurgey.
Maybee—H. Kohler.
Milan—W. P. Lampkin, F. G. Hasley, W. H. Hack.
Niles—W. J. Cameron, S. E. Bolten & Co.
Owosso—O. F. Harryman, Ainsworth & Hanmer, W. E. Payne & Co.,
John Brooks & Sons, Hartshorn & Sons.
Pottsville—H. T. Spears.
Pontiac—Pontiac Ice & Fuel Co., W. M. Kirby, E. Holland & Son.
Port Huron—C. H. Kimball, M. D. Baldwin, C. B. Waterloo.
Petersburg—D. W. Smith, Lyons Bros., E. W. Spencer.
Quincy—Etheridge & Norton.
Reading—S. B. Mallory, Burlingame & Bowen, W. N. Cahow, N. Cane.
Rochester—Geo. Burr, H. J. Winans & Co., E. S. Letts.
Romeo—Hosner & Powell, Eaton, Bliss & Batholemew, Hulburt & Bancroft.
Romulus—Thos. W. McCloughy.
Saginaw—J. P. Derby, C. L. Roeser, Saginaw Beef Co.
St. Clair—E. C. Recor & Sons, G. C. Solus, W. R. Kemp.
Strasburg—C. M. Rau, Weipert & Meyer.
Sturgis—C. Cressler.
St. Joseph—E. Burton, G. K. Pixley.
Schoolcraft—W. J. Thomas, Pursel & Co.
Sanilac Center—William & Dell Dawson.
Shelby—C. F. Hale.
Sparta—Sparta Milling Co.
South Haven—Merrifield Implement Co.
Three Oaks—J. Wood Smith, E. C. Hamlin, Dr. O. Churchill.
Vandalia—F. G. Pollock.
Vicksburg—Vicksburg Lumber Co.
Wayne—Mr. VerDruin.
Wyandotte—Wayman Coal Co.
Ypsilanti—O. E. Thompson & Sons.
Zeeland—I. Vandyke & Co., Henry Dekruif.

Results of analysis of commercial fertilizers for 1903, expressed in parts in a hundred.

Laboratory number.	Manufacturer.	Trade name.		Nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K ₂ O.
					Available.	Insoluble.	Total.	
210	The Armour Fertilizer Works, Chicago.	Bean Grower.	{ Claimed... { Found.....	.82 to 1.65 1.65	8 to 10 10.5	2 to 4 2.5	10 to 14 13	2 to 3 2.31
211	The Armour Fertilizer Works, Chicago.	Bone Meal.	{ Claimed... { Found.....	2.47 to 3.29 2.53	10 to 14 7.6	14 to 16 18.2	24 to 30 26.8	.....
212	The Armour Fertilizer Works, Chicago.	All Soluble.	{ Claimed... { Found.....	2.88 to 3.70 3.32	8 to 10 10.1	2 to 4 2	10 to 14 12.1	4 to 5 5.68
213	The Armour Fertilizer Works, Chicago.	Acidulated Bone Meal.	{ Claimed... { Found.....	1.64 to 2.47 2.36	11 to 14 19.1	7 to 10 2.4	18 to 24 21.5	.....
214	The Armour Fertilizer Works, Chicago.	Grain Grower.	{ Claimed... { Found.....	1.65 to 2.47 2.01	8 to 10 9.21	2 to 4 2.79	10 to 14 12	2 to 3 2.08
215	The Armour Fertilizer Works, Chicago.	Ammoniated Bone with Potash.	{ Claimed... { Found.....	2.47 to 3.39 2.88	6 to 8 7.4	2 to 4 1.1	8 to 12 8.5	2 to 3 2.29
216	The Armour Fertilizer Works, Chicago.	Wheat, Corn and Oats Special.	{ Claimed... { Found.....	.82 to 1.65 .83	7 to 9 8.16	2 to 4 2.14	9 to 13 10.3	1 to 2 1.16
217	The Armour Fertilizer Works, Chicago.	Bone, Blood and Potash.	{ Claimed... { Found.....	4.11 to 4.94 4.60	8 to 10 10.22	2 to 4 3 18	10 to 14 13.4	7 to 8 6.47
218	The Armour Fertilizer Works, Chicago.	Phosphate and Potash.	{ Claimed... { Found.....	.....	10 to 12 10.8	2 to 4 1.8	12 to 16 13.1	2 to 3 1.85
219	The Armour Fertilizer Works, Chicago.	Star Phosphate.	{ Claimed... { Found.....	.....	14 to 16 13	2 to 4 1.9	16 to 20 14.9	.....
220	The Armour Fertilizer Works, Chicago.	Fruit and Root Crop Special.	{ Claimed... { Found.....	1.65 to 2.46 16.0	8 to 10 11.65	2 to 4 1.36	10 to 14 13	5 to 6

221	The Armour Fertilizer Works, Chicago.....	Sugar Beet Special.....	{ Claimed... { Found.....	.82 to 1.65 .91	8 to 10 10.37	2 to 4 1.93	10 to 14 12.3	4 to 6 3.80
222	The Armour Fertilizer Works, Chicago.....	High Grade Potato.....	{ Claimed... { Found.....	1.64 to 2.47 1.45	8 to 10 10.29	2 to 4 1.81	10 to 14 12.1	10 to 12 9.23
310	The Armour Fertilizer Works, Chicago.....	Steamed Bone Meal.....	{ Claimed... { Found.....	1.65 to 2.47 2.66	.....	20 to 22 22.7	20 to 22 22.7	.....
224	Tuscarora Fertilizer Co., Chicago	Bone and Potash.....	{ Claimed... { Found.....	.....	10 to 12 12.56	2 to 4 1.04	12 to 16 13.00	2 to 3 2.06
225	Tuscarora Fertilizer Co., Chicago	Tuscarora Standard.....	{ Claimed... { Found.....	1.65 to 2.46 1.80	8 to 10 9.15	2 to 4 3.61	10 to 14 12.76	2 to 3 4.06
226	Tuscarora Fertilizer Co., Chicago	Tuscarora Trucker.....	{ Claimed... { Found.....	4.11 to 4.94 3.72	8 to 10 9.20	2 to 4 2.16	10 to 14 11.86	7 to 8 8.86
227	Tuscarora Fertilizer Co., Chicago	Wolverine Special.....	{ Claimed... { Found.....	.82 to 1.64 .60	8 to 10 8.91	2 to 4 1.39	10 to 14 10.30	4 to 5 5.24
228	Tuscarora Fertilizer Co., Chicago	Michigan Special.....	{ Claimed... { Found.....	1.64 to 2.46 1.60	8 to 10 8.1	2 to 4 1.6	10 to 14 9.7	5 to 6 4.45
229	Tuscarora Fertilizer Co., Chicago	Tuscarora Fruit and Potato.....	{ Claimed... { Found.....	1.64 to 2.47 1.84	8 to 10 7.6	2 to 4 1.1	10 to 14 8.7	10 to 12 9.38
230	Tuscarora Fertilizer Co., Chicago	Tuscarora Bone Phosphate.....	{ Claimed... { Found.....	.....	10 to 12 9.9	2 to 4 .9	12 to 16 10.8	.....
231	Tuscarora Fertilizer Co., Chicago	Acid Phosphate.....	{ Claimed... { Found.....	.....	14 to 16 16.38	2 to 4 1.17	16 to 20 17.5	.....
232	Tuscarora Fertilizer Co., Chicago	Ammoniated Phosphate.....	{ Claimed... { Found.....	.82 to 1.65 1.06	7 to 9 4.8	2 to 4 2.6	9 to 13 7.4	1 to 2 1.16

Results of analysis of commercial fertilizers for 1903, expressed in parts in a hundred.

Laboratory No.	Manufacturer.	Trade name.	Nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K ₂ O.
				Available.	Insoluble.	Total.	
223	Tuscarora Fertilizer Co., Chicago	Tuscarora Garden.....	{ Claimed... { Found..... 2.88 to 2.70 2.77	8 to 10 9.45	2 to 4 2.85	10 to 14 11.8	4 to 5 4.91
223	Tuscarora Fertilizer Co., Chicago	Steamed Bone Meal.....	{ Claimed... { Found..... 1.65 to 2.45 3.59	8 to 10 6.22	13 to 14 18.96	20 to 24 25.18	.....
224	The Jarecki Chemical Co., San- dusky, O.....	Lake Erie Fish Guano.....	{ Claimed... { Found..... .86 to 1.64 1.66	10 to 12 11.96	1 to 2 2.89	11 to 14 14.75	2 to 3 1.13
225	The Jarecki Chemical Co., San- dusky, O.....	Number One Fish Guano.....	{ Claimed... { Found..... .96 to 1.64 .97	10 to 12 9.75	1 to 2 1.5	11 to 14 11.25	1 to 2 1.04
226	The Jarecki Chemical Co., San- dusky, O.....	C. O. D. Phosphate.....	{ Claimed... { Found.....	14 to 15 17.66	1 to 2 1.44	15 to 17 19.1	.....
227	The Jarecki Chemical Co., San- dusky, O.....	{ Fish and Potash, Potato and { Tobacco Food.....	{ Claimed... { Found..... .86 to 1.64 .98	8 to 9 6.9	1 to 2 7.2	9 to 11 14.1	4 to 5 4.49
229	The Jarecki Chemical Co., San- dusky, O.....	Special Sugar Beet Grower.....	{ Claimed... { Found..... .86 to 1.64 .90	8 to 9 10.2	1 to 2 4.7	9 to 11 14.9	4 to 5 3.84
240	Darling & Co., Chicago.....	Darling's Acid Phosphate.....	{ Claimed... { Found.....	10 to 12 14.62	......48	10 to 12 15.1	.....
241	Darling & Co., Chicago.....	Darling's Chicago Brand.....	{ Claimed... { Found..... 1.65 to 2.50 1.76	8 to 10 8.02	2 to 4 5.73	10 to 14 16.75	2 to 3 2.55
242	Darling & Co., Chicago.....	Darling's Western Brand.....	{ Claimed... { Found..... .41 to .82 .59	7 to 9 9.27	2 to 4 1.93	9 to 11 11.2	.50 to 1 .865
243	Darling & Co., Chicago.....	Darling's Pure Bone and Potash	{ Claimed... { Found..... 2.16 to 2.86 2.86	.....	.....	20.13 to 23.75 25.3	6 to 7 3.52

244	Darling & Co., Chicago.....	{ Darling's Two and Twenty Bone..... }	{ Claimed. Found..... }	1.00 to 2.50 2.47	.....	.....	18 to 22 23.4	.....
245	Darling & Co., Chicago.....	{ Darling's Farmers' Favorite Brand..... }	{ Claimed. Found..... }	2.47 to 3.20 2.51	8 to 10 10.02	2 to — 6.53	10 to — 16.6	4 to 5 3.22
246	Darling & Co., Chicago.....	Darling's Sure Winner Brand.....	{ Claimed. Found..... }	.22 to 1.05 1.01	8 to 10 10.25	2 to — 3.55	10 to — 14.1	3 to 4 3.53
247	Darling & Co., Chicago.....	Darling's Pure Ground Bone.....	{ Claimed. Found..... }	2.50 to 3.17 3.17	.....	.....	23 to 25 27.2	.....
248	Swift & Co., Chicago.....	Sugar Beet Grower.....	{ Claimed. Found..... }	2.50 to 3.25 2.65	8 to 10 10.75	3 to 5 2.35	11 to 15 13	5 to 6 4.79
249	Swift & Co., Chicago.....	Bone Meal.....	{ Claimed. Found..... }	2.50 to 3.25 3.48	.....	.....	25 to 27.50 26	.....
250	Swift & Co., Chicago.....	Bone and Potash.....	{ Claimed. Found..... }	2.50 to 3.25 2.11	.....	.....	23.50 to 26 27.15	3 to 4 3.51
251	Swift & Co., Chicago.....	Onion, Potato and Tobacco.....	{ Claimed. Found..... }	1.04 to 2.47 1.07	8 to 10 7.09	3 to 5 4.81	11 to 15 11.9	7 to 8 6.33
252	Swift & Co., Chicago.....	Special Phosphate and Potash.....	{ Claimed. Found..... }	.....	10 to 12 10.9	1 to 2 2.3	11 to 14 13.2	2 to 3 1.98
253	Swift & Co., Chicago.....	Superphosphate.....	{ Claimed. Found..... }	1.04 to 2.47 1.56	8 to 10 6.59	4 to 6 6.01	12 to 18 12.6	2 to 3 2.09
254	Swift & Co., Chicago.....	Complete Fertilizer.....	{ Claimed. Found..... }	1 to 1.75 1.01	8 to 10 8.94	3 to 5 3.56	11 to 15 12.5	1 to 3 1.17
255	Swift & Co., Chicago.....	Swift's Vegetable Grower.....	{ Claimed. Found..... }	3.25 to 4 3.34	9 to 11 9.74	1 to 3 3.66	10 to 14 13.4	10 to 11 8.49
256	Swift & Co., Chicago.....	Swift's Lawn Fertilizer.....	{ Claimed. Found..... }	3.75 to 4.50 3.85	.....	.....	23 to 27.50 24.45	.....

Results of analysis of commercial fertilizers for 1903, expressed in parts in a hundred.

Laboratory No.	Manufacturer.	Trade name.	Nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K ₂ O.
				Available.	Insoluble.	Total.	
227	Chicago Fertilizer Co., Chicago..	Bone, Blood and Potash.....	1.24 to 2.06 1.01	8 to 10 9.63	2 to — 3.37	10 to — 13	2 to 3 2.56
228	Chicago Fertilizer Co., Chicago..	Wheat and Corn Special.....	.82 to 1.64 1.06	7 to 9 7.28	1 to 2 2.12	8 to 11 9.4	1 to 2 1.72
229	Chicago Fertilizer Co., Chicago..	Potash Special.....	.82 to 1.65 1.02	8 to 10 9.3	2 to — 4.9	10 to — 14.2	4 to 5 5.41
230	Ohio Farmers' Fertilizer Co., Columbus, O.....	Corn, Oats and Wheat Fish Guano.....	1.24 to 2.06 1.32	8 to 10 10.63	2 to — 3.37	10 to — 14	2 to 3 5.84
231	Ohio Farmers' Fertilizer Co., Columbus, O.....	Ammoniated Bone and Potash	.82 to 1.64 1.06	8 to 10 11.06	2 to — 3.85	10 to — 14.9	4 to 5 5.37
232	Ohio Farmers' Fertilizer Co., Columbus, O.....	General Crop Fish Guano.....	.82 to 1.64 1.24	7 to 9 10.33	1 to 2 3.37	8 to 11 13.7	1 to 2 2.62
233	Grand Rapids Glue Co., Grand Rapids, Mich.....	Grand Rapids.....	3 to 5 2.41	6 to 7 4.24	6 to 8 8.11	12 to 15 12.35	1 to 2 .394
234	The American Agricultural Chemical Co., New York City }	Bradley's Alkaline Bone and Potash.....	.....	11 to 13 8.6	1 to 2 2.5	12 to 15 11.1	2 to 3 2.13
235	The American Agricultural Chemical Co., New York..... }	Bradley's Niagara Phosphate..	.82 to 1.65 1.11	7 to 9 8.9	1 to 2 2.3	8 to 11 11.2	1 to 2 1.39
236	The American Agricultural Chemical Co., New York..... }	Crocker's New Rival Am- moniated Superphosphate..	1.23 to 2.05 .88	9 to 11 8.86	1 to 2 1.44	10 to 13 10.3	2 to 3 2.16
237	The American Agricultural Chemical Co., New York..... }	High Grade Garden and Veg- etable Fertilizer.....	2 to 3 2.38	8 to 11 7.55	..... 1.35	8 to 11 8.8	6 to 8 6.80

268	The American Agricultural Chemical Co., New York.....	{ Crocker's Ammonia'd Wheat and Corn Phosphate..... }	{ Claimed..... } { Found..... }	2.05 to 3 2.06	8 to 10 8.64	1 to 2 1.16	9 to 12 9.8	1.5 to 2.5 1.36
269	The American Agricultural Chemical Co., New York.....	{ Crocker's Dissolved Bone and Potash..... }	{ Claimed..... } { Found..... }	.....	10 to 12 10.05	1 to 2 2.06	11 to 14 12.7	2 to 3 1.05
270	The American Agricultural Chemical Co., New York.....	{ Crocker's Universal Grain Grower..... }	{ Claimed..... } { Found..... }	.82 to 1.64 .97	8 to 10 8.06	1 to 2 1.44	9 to 12 9.5	2 to 3 2.60
271	The American Agricultural Chemical Co., New York.....	{ Bradley's B. D. Sea Fowl Guano..... }	{ Claimed..... } { Found..... }	2.06 to 2.88 2.01	8 to 10 8.64	2 to 3 .96	10 to 12 9.6	1.5 to 2.5 2.14
272	The American Agricultural Chemical Co., New York.....	{ Bradley's Soluble Dissolved Bone..... }	{ Claimed..... } { Found..... }	.....	14 to 16 17.3	1 to 2 .7	15 to 18 18	.....
273	The American Agricultural Chemical Co., New York.....	{ Bradley's Dissolved Bone with Potash..... }	{ Claimed..... } { Found..... }	1 to 2 1.11	8 to 10 9.4	2 to 3 .7	10 to 12 10.1	2 to 3 2.09
274	The American Agricultural Chemical Co., New York.....	{ Crocker's General Crop Phosphate..... }	{ Claimed..... } { Found..... }	.82 to 1.64 .95	7 to 9 7.5	1 to 2 1.5	8 to 11 9	1 to 2 .66
275	The American Agricultural Chemical Co., New York.....	{ Crocker's Ammoniated Bone Superphosphate..... }	{ Claimed..... } { Found..... }	2.46 to 3.28 2.48	9 to 11 8.9	1 to 2 1.7	10 to 12 10.6	2 to 3 1.05
276	The American Agricultural Chemical Co., New York.....	{ Niagara Dissolved Bone and Potash..... }	{ Claimed..... } { Found..... }	.....	10 to 12 11.15	1 to 2 1.95	11 to 14 13.1	2 to 3 2.05
277	The American Agricultural Chemical Co., New York.....	{ Niagara Grain and Grass Grower..... }	{ Claimed..... } { Found..... }	.82 to 1.64 .93	7 to 9 6.9	1 to 2 2.6	8 to 11 9.5	1 to 2 2.88
278	The American Agricultural Chemical Co., New York.....	{ Niagara Wheat and Corn Producer..... }	{ Claimed..... } { Found..... }	1.23 to 2.05 1.18	9 to 11 9.7	1 to 2 2	10 to 12 11.7	2 to 3 2.43
279	The American Agricultural Chemical Co., New York.....	{ Niagara Potato and Vegetable Fertilizer..... }	{ Claimed..... } { Found..... }	2.05 to 3 2.29	8 to 10 8.5	1 to 2 1.3	9 to 12 9.9	3 to 4 2.46
280	The American Agricultural Chemical Co., New York.....	{ Fine Ground Bone..... }	{ Claimed..... } { Found..... }	2.47 to 3.30 2.32	.....	.....	22.50 to 25 23.87	.....

Results of analysis of commercial fertilizers for 1903, expressed in parts in a hundred.

Laboratory No.	Manufacturer.	Trade name.	Nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K ₂ O.
				Available.	Insoluble.	Total.	
223	Michigan Carbon Works, Detroit	{ Homestead, a Bone Black Fertilizer..... }	{ Claimed... Found..... }	8 to 11 9.21	..... 1.44	8 to 11 10.65	1.5 to 2.5 1.92
223	Michigan Carbon Works, Detroit	{ Homestead, Potato and Tobacco Fertilizer..... }	{ Claimed... Found..... }	8 to 11 7.66	..... 1.44	8 to 11 9.1	3 to 4 2.35
224	Michigan Carbon Works, Detroit	{ Homestead, Sugar Beet Fertilizer..... }	{ Claimed... Found..... }	9 to 11 9.47	..... 1.33	9 to 11 11.4	2 to 3 4.08
225	Michigan Carbon Works, Detroit	Red Line Complete Manure....	{ Claimed... Found..... }	7 to 10 8.47	..... 2.33	7 to 10 10.8	1 to 2 1.86
226	Michigan Carbon Works, Detroit	{ Red Line Phosphate with Potash..... }	{ Claimed... Found..... }	10 to 12 10.1	..... 3	10 to 12 13.1	2 to 3 2.07
227	Michigan Carbon Works, Detroit	Red Line Phosphate.....	{ Claimed... Found..... }	14 to 16 17.3	..... 1.2	14 to 16 18.5	.....
228	Michigan Carbon Works, Detroit	Wolverine Phosphate.....	{ Claimed... Found..... }	10 to 13 9.5	..... 2	10 to 13 11.5	.....
229	Michigan Carbon Works, Detroit	Banner Dissolved Bone.....	{ Claimed... Found..... }	30 to 34 35.6	..... 3.2	30 to 34 38.8	.....
230	Michigan Carbon Works, Detroit	Desiccated Bone.....	{ Claimed... Found..... }	.....	..... 33.3	25 to 30 33.3	.....
231	Michigan Carbon Works, Detroit	Pure Animal Bone and Potash	{ Claimed... Found..... }	.....	..... 33.3	22 to 26 33.3	6 to 8 2.84
232	Northwestern Fertilizer Co., Chicago.....	Garden City Superphosphate..	{ Claimed... Found..... }	8 to 10 8.13	2 to 3 2.07	10 to 13 10.2	1.5 to 2 1.10

233	Northwestern Fertilizer Co., Chicago	{ Horseshoe Brand Corn and Wheat Grower..... }	{ Claimed... Found..... }	1.64 to 2.36 1.84	8 to 10 9.99	2 to 3 2.01	10 to 13 12.9	2 to 2.5 2.11
234	Northwestern Fertilizer Co., Chicago	{ Horseshoe Brand Potato Grower..... }	{ Claimed... Found..... }	2.46 to 2.29 2.36	9 to 10 9.5	2 to 3 1.7	11 to 13 11.2	2 to 3 2.33
235	Northwestern Fertilizer Co., Chicago	{ Acidulated Bone and Potash..... }	{ Claimed... Found..... }	.82 to 1.64 .94	10 to 12 11.56	2 to 3 2.24	12 to 15 13.8	1 to 1.5 1.49
236	Northwestern Fertilizer Co., Chicago	{ Quick Acting Phosphate..... }	{ Claimed... Found..... }	.....	10 to 12 11.59	2 to 3 1.01	13 to 15 12.6	.....
237	Northwestern Fertilizer Co., Chicago	{ Horseshoe Brand Sugar Beet Fertilizer..... }	{ Claimed... Found..... }	1.23 to 2.05 1.39	9 to 11 10.8	1 to 2 1.6	10 to 13 12.4	2 to 3 2.89
238	Grange Fertilizer Co., Detroit	{ Michigan Grange Acid Phosphate 10%..... }	{ Claimed... Found..... }	.....	10 to 13 10.35	..... 2.15	10 to 13 12.5	.....
239	Grange Fertilizer Co., Detroit	{ Michigan Grange Acid Phosphate 14%..... }	{ Claimed... Found..... }	.....	14 to 16 15.9	..... 1.4	14 to 16 17.3	.....
240	Grange Fertilizer Co., Detroit	{ Michigan Grange Wheat and Oats Special..... }	{ Claimed... Found..... }	2.06 to 2.88 2.87	8 to 11 7.8	..... 1.7	8 to 11 9.5	2.5 to 2.5 1.73
241	Grange Fertilizer Co., Detroit	{ Michigan Grange Corn, Oats and Grass..... }	{ Claimed... Found..... }	1.65 to 2.5 1.86	8 to 10 7.5	..... 1.7	8 to 10 9.3	2 to 3 2.87
242	Grange Fertilizer Co., Detroit	{ Michigan Grange Complete Manure..... }	{ Claimed... Found..... }	.83 to 1.65 1.03	7 to 10 7	..... 2	7 to 10 9	1 to 2 1.09
243	Spiegel & Swartz, Grand Haven, Mich.	{ Celery Hustler..... }	{ Claimed... Found..... }	7 to 8 7.08	3.17 to 3.4 1.13	.69 to 1.41 2.9	3.86 to 4.81 4.08	1.55 to 2.88 2.16
244	The Cincinnati Phosphate Co., Cincinnati, O.	{ Capitol Wheat Grower..... }	{ Claimed... Found..... }	.....	14 to 15 13.6	1 to 2 2.5	15 to 17 17.1	.....

* Ammonia 1.50 to 2.50.

Results of analysis of commercial fertilizers for 1908, expressed in parts in a hundred.

Laboratory No.	Manufacturer.	Trade name.	Nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K ₂ O.
				Available.	Insoluble.	Total.	
306	The Cincinnati Phosphate Co., Cincinnati, O.	Capitol Grain and Grass Grower	.82 to 1.04 .83	10 to 12 13.3	1 to 2 1.8	11 to 14 15.1	1 to 2 1.85
306	The Cincinnati Phosphate Co., Cincinnati, O.	Capitol Dissolved Bone and Potash	.....	12 to 13 15.1	1 to 2 2	13 to 15 17.1	3 to 4 3.78
307	The Cincinnati Phosphate Co., Cincinnati, O.	Capitol Alkaline Bone	.....	10 to 11 11.5	1 to 2 3.4	11 to 13 14.9	2 to 3 2.15
308	The Cincinnati Phosphate Co., Cincinnati, O.	Capitol Tobacco Food	.82 to 1.04 .79	8 to 9 9.6	1 to 2 4.3	9 to 11 13.7	4 to 5 3.65
315	The Hardy Packing Co., Chicago	Hardy's Crop Producer	.82 to 1.04 .96	7 to 9 7.58	2 to 3 3.42	9 to 12 11	1 to 2 2.96
316	The Hardy Packing Co., Chicago	Hardy's Tankage Bone and Potash	1.23 to 2 1.31	8 to 10 8.14	2 to 3 3.96	10 to 13 12.1	2 to 4 3.44
317	James Boland, Jackson, Mich.	Bone Meal	14.04 3.48	3.66 10.15	15.52 12.85	19.18 23	.....
318	James Boland, Jackson, Mich.	Blackman	2.5 to 3.5 1.91	10 to 12 1.4	.90 to 1 7.6	10.9 to 13 9	3 to 4 3.96
320	Kalamazoo Rendering and Fertilizer Co., Kalamazoo, Mich.	Kazoo Brand	*6.1 5.85	1.99 2.15	8.79 7.85	10.78 9.4	.....

* Ammonia 7.4.
† Ammonia 4.91.

The following analyses are inserted inasmuch as numerous letters are received yearly requesting information on the goods mentioned in this table. These analyses are not original with this bulletin, but are compiled from various sources and represent a great variety of conditions. The averages here given should therefore represent more closely the average farmer's condition than would specific and individual analyses:

Authority.	Product.	Nitrogen.	Phosphoric acid.	Potash.
Landwirtschaftlicher Kalender, 1896	Fresh barnyard manure.	0.39%	0.18%	0.45%
" "	Well rotted manure.....	0.58%	0.30%	0.50%
" "	Fresh horse manure.....	0.58%	0.28%	0.53%
" "	" cow "	0.44%	0.17%	0.35%
" "	" sheep "	0.53%	0.28%	0.67%
" "	" hog "	0.45%	0.19%	0.60%
U. S. Dept. Agriculture, 1894.....	" hen "	1.10%	0.85%	0.56%
Roberts—Fertility of Land.....	" horse urine.....	1.55%	.....	1.50%
" " "	" cow "	0.58%	.....	0.49%
" " "	" sheep "	1.95%	.....	2.26%
" " "	" hog "	0.43%	0.83%	.....
Michigan Experiment Station	Wood ashes, unleached.....	.....	1.68%	4.24%
" " "	" " leached.....	.....	1.43%	0.36%
Soils and Fertilizers—Snyder.....	Hard coal ashes.....	.....	0.10%	0.10%
" " " "	Soft " " .....	.....	0.40%	0.40%

MOSQUITOES AND OTHER INSECTS OF THE YEAR 1902.

BY R. H. PETTIT, B. S., ENTOMOLOGIST.

Special Bulletin No. 17.

It would be difficult indeed to look back to the time when mosquitoes have not been a nuisance; when they have not rendered life miserable to man and beast; when they have not been a menace to health and even to life itself; and yet during all these generations their torments have been endured and many of our ancestors have died from diseases spread by these pests.

It is only in very recent years that attention has been directed toward experiments relative to their destruction and toward investigations as to their ability to carry disease from one individual to another. We are indebted to Dr. L. O. Howard for starting and maintaining the experiments in relation to killing the pests.

The life-history of the mosquito is well known in a general way. The eggs of the common *Culex* or non-malarial mosquito are laid in raft-like masses on the surface of still water, being stuck together side by side in large numbers, sometimes more than three hundred in a mass. The eggs of the malarial mosquito, *Anopheles*, are said to be laid separately on the water without being joined into a raft-like body. These eggs hatch usually in one or two days, by openings or lids on the under side, giving forth small wigglers. The wigglers are so common and so well known that a description seems superfluous, slender little creatures, each with a swollen thorax and a head at the lower end, and with a slender breathing tube at the upper end, which tube is thrust up through the surface of the water to obtain air. Usually the larva rests at the surface of the water, its breathing-tube projecting above the surface film, leaving the head free to feed on microscopic plants and animals. After a time, varying from a week to several months, the larva changes to a pupa. The skin of the larva splits and the robust, swollen pupa emerges. In this condition the insect breathes by means of two trumpet-shaped tubes which project from the shoulders. After about two days more the pupal skin splits down the back, and spreading open, allows the adult winged mosquito to emerge, using the old pupal skin as a support on which to stand while drying her legs and wings. After this is accomplished, the adult flies away to mate, lay the eggs for a future brood, and if she is fortunate enough, to taste human blood.

As has been hinted, we have here in Michigan a number of different kinds of mosquitoes. The commoner sorts belong to the two genera, *Culex* and *Anopheles*, the former are by far the more numerous in summer time and are the ones usually seen in the open and during the day time. They are not known to carry the germs of disease but are classed simply as nuisances. *Anopheles*, on the other hand, seems to prefer such localities as are sheltered by trees, houses, etc., and while it will bite during the day time, it is more apt to choose the night for its excursions. The two genera can easily be distinguished by an examination of the mouth-parts. In *Anopheles* the palpi are nearly as

long as the proboscis in both sexes, and the color is brown or brownish-black. In *Culex*, the palpi of the female are less than half as long as the proboscis, while that of the male is as long as the proboscis. *Culex* rests with the body parallel to the support. *Anopheles* is large and has very long legs. Beside this it rests with its body away from the support to which it clings. The veins in the wings of *Anopheles* are covered with black scales and in one species there are four black spots on each wing; in the case of the other species there is a white spot on the wing near the apex.

By far the most interesting fact known about *Anopheles* is one recently discovered, viz., that it can and does transmit the germs of malaria from one person to another, thus spreading the disease known as fever and ague, often with fatal results. We are all familiar with the reputation that Michigan used to enjoy before the State was well drained and when pools were everywhere present. It is now believed that the mosquitoes belonging to the genus *Anopheles* are responsible for spreading the disease wherever it occurs. Of course if the disease be not present the mosquito will not produce it. The germs have first to be obtained from some person already suffering from the disease, but once introduced, the mosquito will spread the trouble. It is even claimed that the infection can be spread in no other way. In view of these facts, an experiment was instituted during the summer of 1902, the object of which was to verify the facts discovered by various experimenters and to apply remedial measures, as well as to find out any new facts which might come to light bearing on the question. The time chosen for the work proved to be one almost without a parallel as to weather. The summer was wet. Rain fell in abnormal quantities from early spring until fall and for this reason the results have been very different than was expected. The field work was almost entirely done by Mr. Bronson Barlow, and it was owing to his efficient work and careful notes and observations that the work was rendered possible.

A glance at the map will show that the College is a very good place for an experiment of this kind, being adjacent to many marshes and ponds and having several ponds on the campus itself. In planning the work, a large map was first made, on which were indicated all places suspected of harboring mosquitoes. This area was divided into regions and these regions were considered as units. The original plan being to see what could be done for \$100, it was necessary to limit the work to an area capable of being treated for that sum. The remedies used were two in number, viz., petrolizing or treating with some form of petroleum oil, and introducing fish into pounds. The grade of petroleum oil used was that which was recommended by Dr. Howard and which is known as light fuel oil. It is hoped that a third measure and one far superior to either of the two proposed will be provided for soon. I refer to draining. Draining ends the matter once and for all whenever it is feasible, and while the surroundings hereabout may not be called wet, still there is a sufficient area of water to stock the place with mosquitoes. As will be shown, it requires but a small amount of water to stock a neighborhood.

In April, examinations were made of all the ground which was to be covered and as soon as the adults appeared, the ponds were treated with oil. This occurred on April 21. The oil was applied at the rate of one-half gallon to 1,000 square feet or one ounce to 15 square feet. This

amounts to about half a barrel to an acre. It was usually applied by means of a knapsack spray-pump fitted with a plain nozzle, that is one having a hole 3-32 of an inch in diameter. With this it was possible to throw the oil 20 feet or more in a solid stream and thus to reach far in toward the center of a pond.

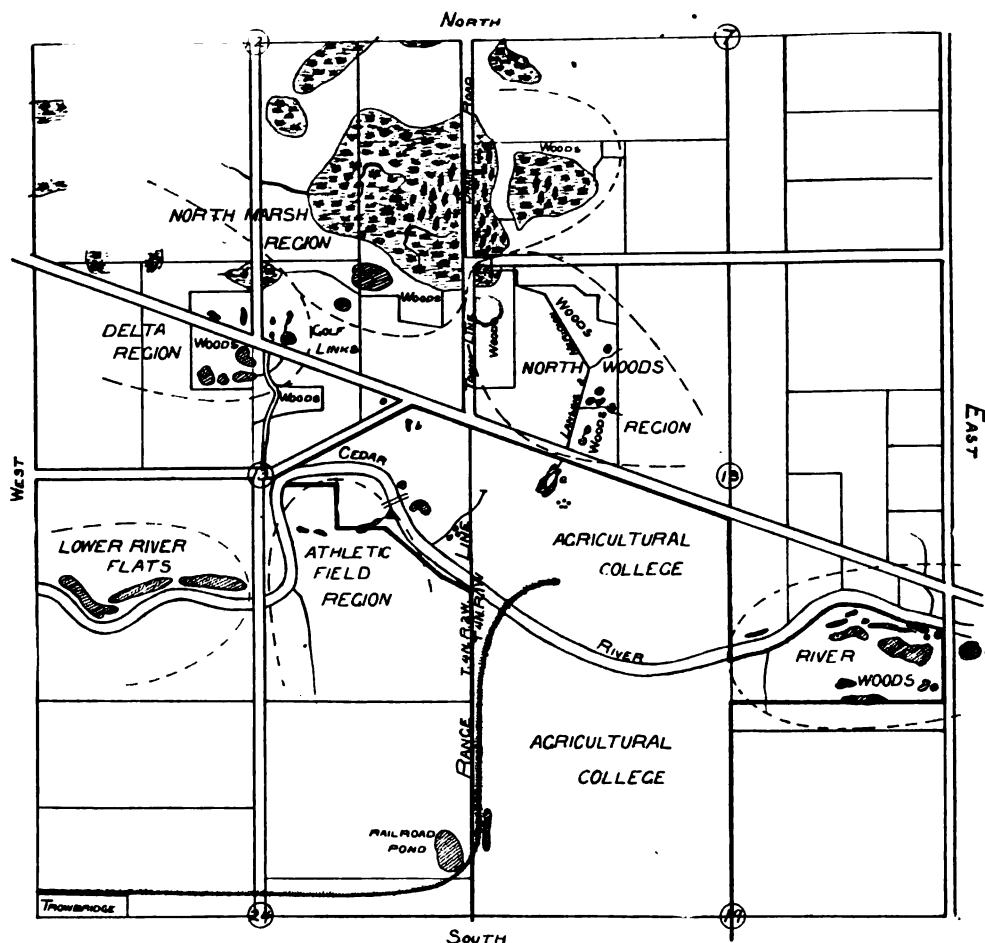


Fig. 1.—Map of the Agricultural College and surroundings, covering an area of two miles square, or four square miles, Original.

The oil acted perfectly. It immediately spread out into a thin film, covering the water and killing all the pupae within two hours. The larvae required more time, but all were dead in a few hours. The extermination was complete, no larvae or pupae being left alive.

The land about the campus was divided into eight regions, which regions take their names from some land in or near them. The names are here used arbitrarily and the areas here considered do not correspond with the names used in the ordinary sense. Arbitrary areas

used in the map are as follows: north woods region, north marsh region, Delta region, lower river flats, athletic field region, campus, river woods, railroad pond.

The north woods region comprises a piece of woods with ponds in it, some swamp with trees standing in the water, and a long ditch which ordinarily dries up in summer.

The north marsh region includes about 40 acres of marsh with standing water over a good portion of it, especially around the borders. This region also includes several ponds, as shown in the map.

Delta region contains a number of pools in second-growth wood and some in the open.

The lower river flats contain a number of long flood ponds near the river. They dry up before many mosquitoes emerge.

The athletic-field region contains many ponds with trees growing in them. They are protected from the wind by the trees and offer good breeding-places.

The campus contains the pond by the woman's building, a good-sized pond full of ornamental water-plants and covered, from the middle of August on, with confervae and other vegetation, unless artificially removed; the botanic garden ponds, which contain many native plants and which would make a fine breeding-place for mosquitoes but for the fish which have been introduced. Beside these ponds there are ponds along the river bank and a group of small tanks for growing water-lilies, etc.; a pond in the elk-park and an open drain which is stocked with minnows and sticklebacks.

The river woods contain a chain of shallow pools near the river. These pools breed mosquitoes in large numbers.

The railroad pond is an open pond exposed to the wind and sun without any shelter at all. No mosquitoes have been found in it thus far.

Following is a record of work done with oil:

The north woods were treated on April 26, May 24, July 11.

The north marsh region April 26.

Delta region, April 28.

The lower river flats, no mosquitoes.

Athletic field, April 21, May 27, July 10.

Campus, April 21; along river shore, July 10 same.

River woods, April 29, May 24, July 15.

Railroad pond, no mosquitoes.

Beside these places small transient pools were treated from time to time. During the middle of May mosquitoes appeared in numbers.

NUMBER OF LARVAE AND PUPAE FOUND IN A GIVEN AREA.

On April 24, a piece of woods known as the railroad woods was visited by the writer in company with Mr. Barlow. It was intended early in the season to include this region in the experiment but for certain reasons it was deemed inexpedient to do so. However, a count was made of the number of larvae and pupae in the water at that time. The pools were distributed as they ordinarily are in our woodland; several large ponds with small pools around the border. Some of these small pools connect with the main pond and some are cut off by the slow sinking of the water. In these small, shallow pools the mosquitoes swarmed. In a typical one, about fifteen square feet in area, a count

was made. The number of larvae found was nine hundred to the square foot. In larger pools one hundred were found. Later in the season, when the pupae congregated before emerging, the number collected was so large that one hesitates to give them; however, in that case they were not evenly distributed throughout the water.

The method of making accurate counts was as follows: A square frame, just a foot square and an inch deep, was made of strong galvanized iron. On the bottom of this frame was fastened fine brass netting and this was marked into squares measuring an inch to the side. A

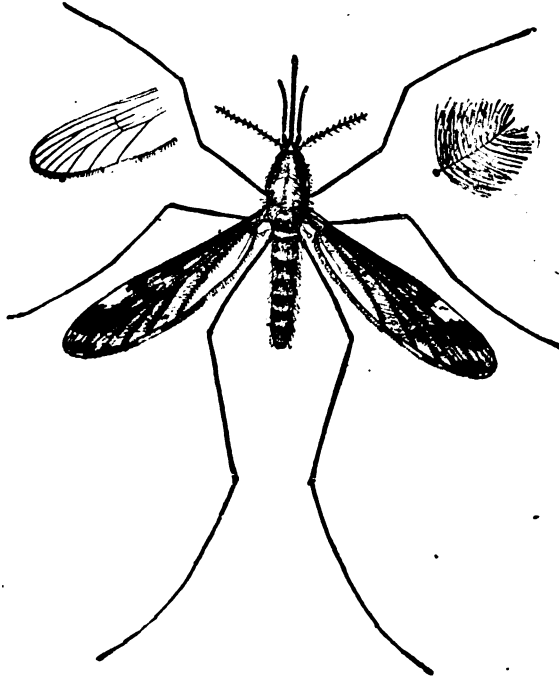


Fig. 2.—Malarial mosquito, from Howard, Bulletin 25, n. s., U. S. Department of Agriculture.

handle was attached to one side and the counting net was complete. It amounted to a square dip net with a flat bottom marked into inch squares. In using it, the net was slid into the water and left on the bottom for a time until the larvae and pupae had settled into their accustomed places. The net was then raised directly upward, lifting out all of the wigglers. A count of representative squares or, in case the number was small, a count of the entire surface quickly gave the whole number.

In searching for the wigglers, it is convenient to have a dip net of fine wire screening covered inside with Swiss muslin to render it white. The larvae are most easily seen against a white ground. When the wigglers are present in numbers, the water will often look as if a fine rain were falling. This is caused by the larvae and pupae as they come to the surface to breathe. This dimpling often helps to reveal the whereabouts of the mosquitoes.

In fighting mosquitoes, constant search is necessary. A pond may be free from wigglers early in the season and fairly swarm with them later. The insects seem to become less critical in their choice of breeding places as the season advances, no doubt due to the fact that many of their breeding places dry up, and competition becomes more acute. Another reason is that many of the ponds become covered with a vegetable growth suitable for the protection and food of *Anopheles*.

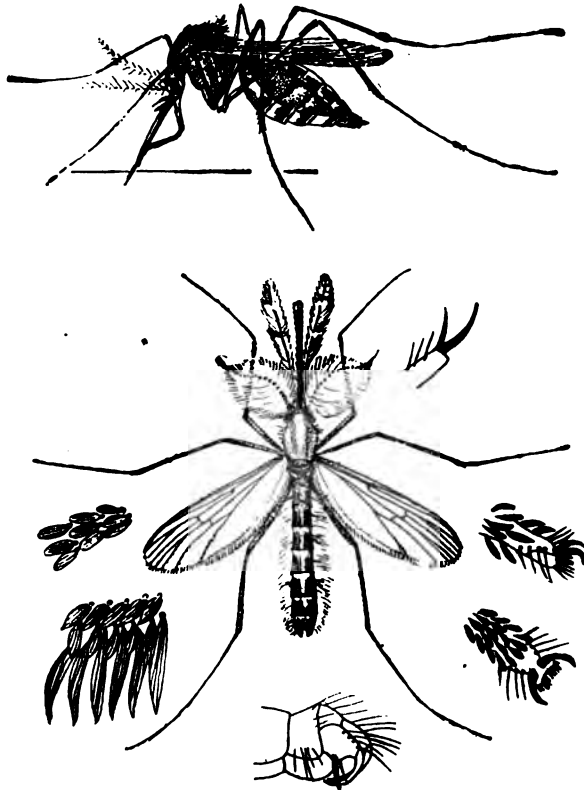


Fig. 3. Non-malarial mosquito, from Howard, U. S. Dept. of Agr., Bul. 25, p. 8.

Another fact of interest in this connection is the habit of bunching practiced by the pupae. Early in the season the wigglers are more or less equally distributed over the surface of the water. When the warm weather appears, the pupae are apt to collect in dense masses and in sheltered places, often being overlooked for this reason.

BREEDING PLACES.

Many surprises were experienced in relation to the breeding places of these pests. Mr. Barlow found a hollow in the body of a tree caused by the breaking of a limb, twenty feet above the ground, which hollow contained enough water to support a flourishing family of mosquitoes. On the other hand, several ponds which at first looked like

favorable places were not infested at all. The one marked railroad pond, an open pond, unprotected in any way, and exposed to the sun and to the wind, was entirely destitute of wigglers so far as we could find. Low swales in which stood poplars and willows offered good breeding places, the trees and brush protecting the surface from the wind, keeping the surface of the water smooth and providing a place for the adults to emerge. Mosquitoes can not emerge in the presence of a wind or when the surface of the water is rough, because they are easily swamped and drowned.

The open pond on the campus near the woman's building at first promised to be free from wigglers. It was poorly protected from the wind and a number of sun-fish were introduced. On the 9th of August, however, the larvae of *Anopheles* were found, together with a very few larvae of *Culex* the confervae having by that time formed a mat over the surface of the water which mat served as a protection from the fish and the same time furnished food for the larvae. Shortly after this, the pond was treated with a spray of copper sulphate which killed the confervae as well as the mosquitoes.

The ideal places from the standpoint of the mosquitoes were found in woodland, in small pools of standing water. Here they bred in myriads, both *Culex* and *Anopheles*.

Cisterns are said often to be stocked with wigglers. Those on the campus seem to be well protected, none containing mosquitoes although several were examined. One open cistern which contained wigglers was found at some little distance. The cisterns should be made tight and all inlets should be carefully screened with fine wire netting.

NUMBER OF SPECIES OF MOSQUITOES CAPTURED.

Many hundreds of mosquitoes were captured and bred from the larval and pupal stages during the summer and among them are to be found eleven species. They are named as follows:

Psorophora ciliata.
Anopheles maculipennis.
Anopheles punctipennis.
Conchyliaestes musicus.
Urotaenia sapphirina.
Culex stimulans.
Culex pungens.
Culex impiger.
Culex triseriatus.
Culex pipiens
Culex perturbans

CONTROLLING THE MOSQUITO NUISANCE.

In his admirable book entitled "Mosquitoes, How They Live, How They Carry Disease, How They May Be Classified, How They May Be Destroyed," Dr. L. O. Howard recommends three methods of combatting mosquitoes,—First of all, draining and filling, this is to be done wherever possible. Second,—treating with petroleum; and Third,—the introduction of fish which will eat mosquitoes. No draining was

attempted this year, but it is hoped that considerable water can be disposed of before another year. Oil was used liberally at the rate of one ounce to fifteen square feet of water. The grade known as light fuel oil was used. This cost about \$3.50 F. O. B. at Detroit, or a little less than \$4.50 per barrel at the College. Its effect lasts at least three weeks, that is, it lasts one week before it ceases to kill larvae and two weeks are usually required for the insect to mature from the egg. The oil kills much of the vegetation.

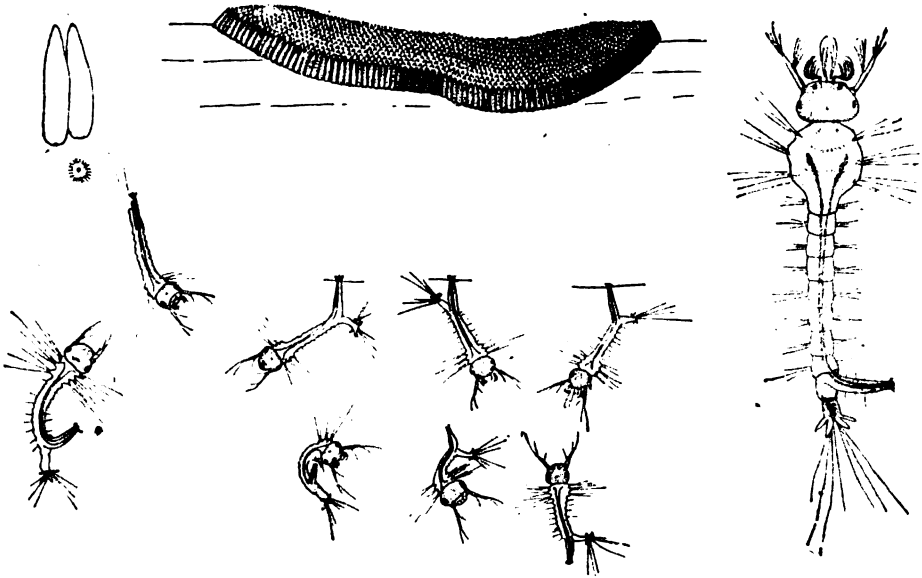


Fig. 4. Larvæ and eggs of non-malarial mosquito, from Howard, U. S. Dept. of Agr., Bul. 25, n. s.

There are several other aquatic pupæ which may be mistaken for the wigglers, notably those of *Corethra*. Many times the pupæ of this fly were brought to us, under the impression that they were mosquito wigglers. Crustacea and insects with closed tracheal systems usually are not killed by the oil, thus larva of *Corethra* and May-flies lived with little if any inconvenience, and the fairy shrimp was distressed but was not killed.

FISH.

Dr. Howard highly recommends the introduction of small sun-fish and sticklebacks in places where they may be expected to live. Sun-fish were introduced into the pond near the woman's building, and sun-fish and stickle-backs into a deep pond in the elk-park. Sun-fish were already present in several ponds in the botanic garden. In none of these places were wigglers found except in the pond near the woman's building and in this only after the confervæ offered good hiding places for them.

Sun-fish, sticklebacks and mud-minnows* quickly eat the larvæ and pupæ when in aquaria. One small sun-fish, not over an inch and a quarter long, was fed fourteen good sized larvæ at a meal and next day he ate twenty more. While the sticklebacks and mud-minnows did not eat so greedily, they disposed of many mosquitoes.

The mud-minnow, a small inconspicuous fish, was found in many swales and pools, and wherever found the wigglers were fewer in number, however, they never seemed to be present in sufficient force to entirely eradicate the pests unless introduced artificially.

As has been stated, the season in Michigan was extremely wet. Rain fell at short intervals so that in many places pools remained all summer where ordinarily they dried up in June. Then too the grass was almost



Fig. 5 —Brook sticklebacks, male and female, slightly enlarged, Original.

constantly wet, a condition very favorable to mosquito life, and while many millions have been killed in the area treated, the insects have drifted in from the outside. We all know that mosquitoes flourish near water. They must have water and ordinarily they are not supposed to drift far from water. It is probable that the wet grass this season has enabled them to drift much farther than ordinarily. Mosquitoes appeared during the middle of May and continued to be in evidence all through the warm weather. We can imagine how numerous they would have been if the many millions which were killed had been left to live. Another factor which worked against us was the direction of the prevailing winds. Ordinarily, the wind is from the southwest. Much of the time during the past summer, the wind has come from

*The sun-fish being immature have not been determined. The mud minnow is *Umbra limi* as kindly determined for me by Prof. Raymond Osborn. The stickleback is the one known as the brook stickleback, *Eucalia inconstans*.

the northwest, the direction in which lie the nearest mosquito breeding pools.

DISEASE OF THE MOSQUITO.

On August 5, Mr. Barlow found a number of adult mosquitoes killed by a fungus, *Entomophthora* sp. nov. They were very numerous on the margins of one of the pools in the north woods, sometimes almost covering the soil and the pieces of bark to which they clung. Some were just killed and showed little, if any, external growth, and some were covered with a dense dull white growth. All were within a few inches of the water and all faced away from it. Imagine thousands of mosquitoes all headed away from the water as if they were trying to get away from it.

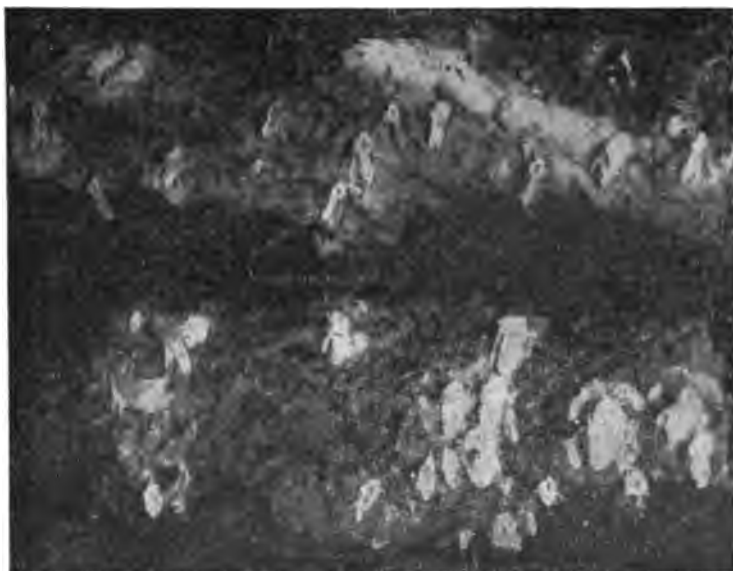


Fig. 6.—Mosquitoes killed by disease, nat. size, original.

It would seem that the effect of the disease is to draw the affected insects to the water, possibly by creating a thirst, after slaking which the insects, in trying to retreat, are caught and stopped in their course by numerous rhizoids or anchor ropes which are sent out by the fungus in the body to fasten the victim permanently to the place where its ill luck overtakes it. Unfortunately for the mosquito host, the diseased individuals die just in the right place to infect their fellows as they go to the pool to drink or to lay eggs. This is a case where the fungus seems to influence the host in such a way as to lead to the spread of the disease. Similar impulses seem to be induced in the case of other species,—the *Sporotrichum* that is used against chinch-bugs seems to impel the diseased individuals to hide under clods or in other moist and protected places, just the places where the young bugs come to shed their skins or to molt. This is of course the best possible way to spread the disease. Then, too, in the case of the common grasshopper disease, *Empusa grilli*, the dying

hoppers are impelled to climb to the tops of weeds and plants, and as the fungus throws its spores to some distance, there is a good chance that some of them will fall on the bodies of other grasshoppers.



Fig. 7.—Mosquitoes killed by fungus disease, enlarged, Original.

The appearance of the mosquito fungus is quite characteristic. The entire body is swollen and covered with a dull white growth, sometimes almost plumbeous. The body is fastened down by many slender brownish ropes. A microscopic examination shows the growth to be made up of



Fig. 8.—Muscid killed by disease, enlarged, Original.

fine threads (mycelium) bearing spores at their distal extremities. These threads are usually simple, though sometimes bearing a few short branches. They are septate at long intervals, granular, and contain vacuoles. The spores are lunate, bluntly rounded at both ends. In size they measure about 50 microns long by 13 in diameter, some being as long as 55 microns and a few as short as 28 microns. They are finely granular, with oil globules usually near the ends. In a single specimen large numbers of resting spores were found. In this case the mycelium had largely disappeared. The resting spores were spherical, hyaline, with many small translucent interior globules. They measured from 40 to 44 microns in diameter.

The fungus also was found at the same time on several specimens of Muscidae, on a *Cheironomid*, and on *Diplax*, probably *D. rubicundula*. Attempts were made to introduce the disease into new regions, but with little success. In the laboratory, a large piece of bark bearing mosquitoes killed by the disease was placed in a cage with many mos-



Fig. 9.—Spores and resting-spores of mosquito disease (*Entomophthora*). greatly enlarged, Original.

quito larvae and pupae. A few adults died after emerging but not nearly all of them.

On August 7, a number of pieces of bark covered with mosquitoes killed by the fungus, were placed on the margins of a pool in the river woods. The disease had not previously appeared in that section. On August 13 a few dead mosquitoes were found near the place where the infection was made. On August 23, the disease was widespread throughout these woods.

THE LONG LECANIUM AND ITS FUNGUS DISEASE.

Lecanium longulum. Doug.*

A scale-insect, very common in our green-houses, is *Lecanium longulum*. It is found on *Ficus* very abundantly and also on *Monstera* and *Oroton*. Fig. 10 shows this scale in its characteristic form, on a twig of fig. Fig. 11 shows the same scale on a leaf of the same plant. The

* Kindly determined for me by Mr. Theo. Pergande of the Department of Agriculture, Wash.

scale is long and narrow, of a yellowish brown color and with blackish markings along the sides. It is from 4 to 5 mm. long and 2 mm. or more in breadth, varying somewhat in proportion with the part of the

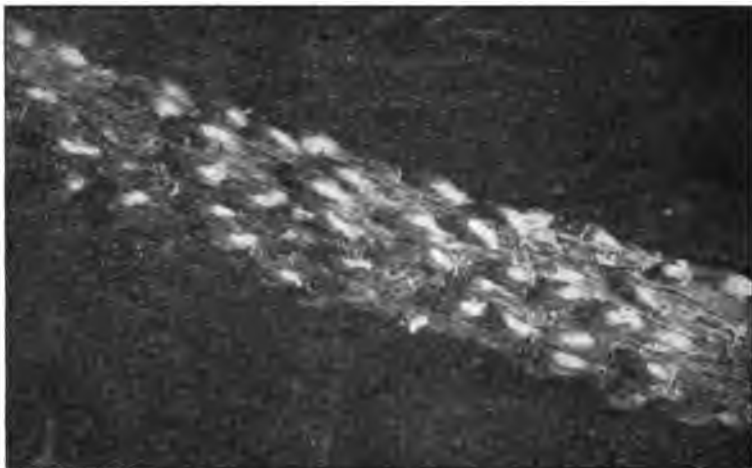


Fig. 10.—Twig of *Ficus* with adults of long Lecanium, enlarged. Original.

host-plant attacked. Those on the twigs are always longer and more elevated, while specimens on leaves are usually more flattened.

The original description by Douglas* applies perfectly to our specimens. It is as follows:

"Female scale dingy pale, yellowish-grey, elongate, narrow, ends broadly rounded, side margins slightly curved out, not recurved; sur-



Fig. 11.—Leaf of *Ficus* with adults of long Lecanium, enlarged. Original.

face smooth, transversely arched, longitudinally level, semi-cylindric, not carinate, a band of faintly dark reticulation along the sides,

* Entomologist's Monthly Magazine, Vol. 24, 1887, pp. 97 b.

whence, in some examples, faint lines radiate to the margin; the disc occupied by a long, pale, clear, oval spot; or in some mature specimens the scale is entirely yellowish-brown, the dorsal pale spot partly or wholly covered and on the sides minute pale dots in place of reticulation. Under side all pale, a broad space all around the insect. A conspicuous blackish eye-spot above each antenna. Antennæ of eight joints: The first short; the second longer, about the same length as the fourth; the third longest of all; the fifth longer than the fourth, but



Fig. 12.—Antenna of adult female long Lecanium, greatly enlarged, Original.

not so long as the third; the sixth, seventh and eighth shortest, the eighth longest of the three, which (especially the terminal) have all gradated sides. The eighth, indeed, simulates two joints, but the gradated structure and want of color make it impossible to determine with certainty whether or not there is a real articulation. Young larvae under the scales. Length 4 to 5, breadth 2 to 2.25 mm. No male scales seen."



Fig. 13.—Anal plates and appendages of adult female of long Lecanium, greatly enlarged, Original.

Mr. Douglas records the scale on *Acacia catechu*, *Anona muricata*, *Murica fragifera* *Averrhoa carambola* and *Spathophyllum blandum*.

The young of this insect are born alive. They are protected for a short time in a pocket or cavity in the under side of the body of the mother. This cavity is large enough to accommodate eight or ten of

the newly-born larvae; it is mottled in the cases of old specimens with dark brown or black. The antennae of the adults seem to be seven-jointed in our specimens; that is, joints seven and eight are not separated as seen by Douglas. The line where they should be separated is clearly to be seen, however.

The internal tube leading to the anal opening bears six long hairs at its cephalic end, and at the caudal end, where it joins the anal plates, it bears six or seven shorter hairs. See Fig. 13.

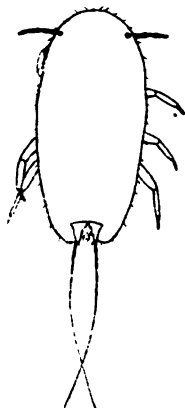


Fig. 14. — Larva of long Lecanium, first stage, enlarged. Original.

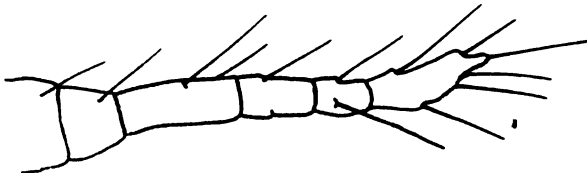


Fig. 15. — Antenna of larva of long Lecanium, first stage, greatly enlarged. Original.

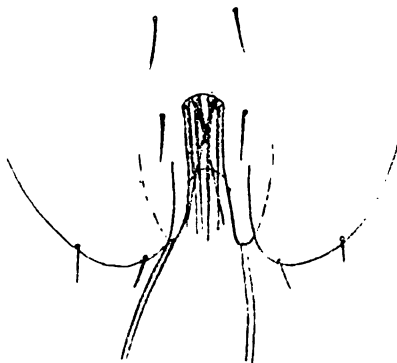


Fig. 16. — Anal plates and appendages of larva of long Lecanium, first stage.

The newly-born larva is shown in Fig. 14. It has antennæ with six joints only, and the anal plates are each provided with a long hair. The internal tube possesses a ring at the cephalic end provided with six hairs, as is the case of the adult. Fig. 16 shows a female larva of the first stage from the ventral side, with this tube in the natural

position. Fig. 17 shows a similar larva with the tube evaginated. In this case, the ring with the six hairs is clearly seen. The young larvae are covered with a very thin coat of wax and are marked with a number of transverse lines or fasciae, which become obscure with age.

This pest is attacked and killed annually by a fungus (*Isaria lecanifera* sp. nov.) noticed on this page. But for this fungus disease the scale would be of considerable importance in green-houses.

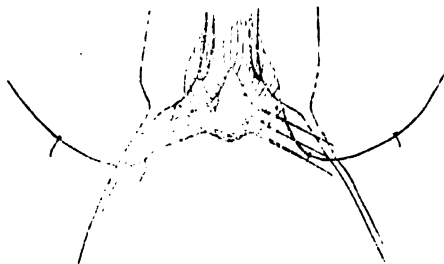


Fig. 17.—Same as Fig. 16, anal tube evaginated.

THE FUNGUS DISEASE OF LONG LECANIUM.

Isaria lecanifera sp. nov.

For the past five years, at least, there has been present in the College green-house a fungus disease working on scale-insects of the species known as *Lecanium longulum*. Its work has been so effective that it is at times very difficult to obtain specimens of the insect host. The whitened bodies of the dead coccids are everywhere, but with very few, if any, healthy scales to be seen.

On February 8, 1902, several good specimens of the diseased scale were obtained from the green-house and dilution cultures were made. When working normally on the scale, the fungus forms a dense felt, sometimes merely bordering the scale with radiating filaments, sometimes making a thin film over the back of the coccid and at other times becoming thickened and covering the scale entirely and hiding it from view. The color of the growth is white or yellowish-white, sometimes distinctly egg-yellow.

No *Isaria* sporophores were seen, but the fungus is placed in the genus *Isaria* because of its very close affinity to the *Isaria* stage of *Cordyceps clavulata*. The gonidia are oval, from $2\frac{1}{2}$ to 4 microns long and about $2\frac{1}{2}$ microns in diameter.

TECHNICAL DESCRIPTION OF FUNGUS DISEASE.

On Agar Agar—After six days, the growth in agar agar plates had progressed so well that bits of growth were taken out and placed in tubes of sterilized wort. No gonidia were produced on agar. In wort the growth was rapid and luxuriant. One of the pieces of agar floated on the wort and in three days the growth had become one-fourth of an inch in diameter, being nearly hemispherical in form. A bit of growth that sank grew on the bottom, trying to put up a forest of fine filaments to the surface of the wort. In five days, the mycelium under the

surface of the wort, in the case of the floating growth, becomes slightly yellowish, the part in the air remaining snow-white, and radiating in fine threads from the centers of growth. In six days the top of the wort becomes nearly covered. The growth extends in small radiate, almost transparent growths, about one-fourth of an inch in diameter upon the walls of the tube for a distance of three-fourths of an inch above the surface of the wort. In ten days the mycelium becomes felted and yellowish in color,

On Potato—Cultures on potato, in test-tubes become nearly covered with a felted growth in about seven days. The mycelium, where it comes in contact with the liquid, is white and cream-colored. There is no color on the potato when grown in this way. The surface exposed

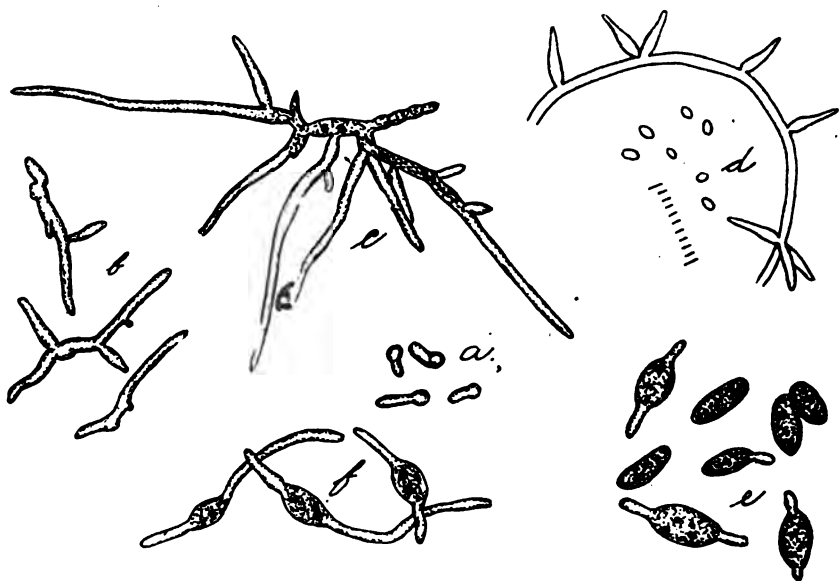


Fig. 18.—Development of spores of Lecanium disease: *a*, gonidia germinating, after 18 hours in agar; *b*, after 24 hours; *c*, still later; *d*, aerial threads with sterigmata and gonidia; *e*, hyphal bodies, some germinating, enlarged, original.

to the air is quite yellow in color. Filaments grow up the sides of the tube, making a narrow border. When grown in larger quantities in Ehrmeyer flasks, it produces elevated, yellowish felted masses in places, with a thin, transparent, white growth all over the potato. After about twelve days, the potato is tinged with a slight purple near the more dense growths. The points where the inoculation took place are covered with elevated masses of felt. After about a month, one flask showed a number of differentiated points of growth, small and elevated, appearing like small white shot laid on the surface of the growth. These may have been the result of an attempt to produce a perfect stage. No structure could be made out on microscopic examination.

On Corn Meal—On corn meal and wort the growth is slow. It is white at first but later it turns yellowish in places. The growth spreads from small elevated centers.

In Agar Plates—The gonidia show germination to be well started after eighteen hours, usually one germ tube being put out at a time. Later a second tube usually is put out opposite the first. The gonidia early nearly disappear, being marked by granular protoplasm, the tube being hyaline at this stage. After twenty-four hours branching commences, the older parts being granular, the growing parts remaining for the most part hyaline. The branches start at a wide angle, often being slightly constricted at the base. This branching under the surface goes on rapidly. After about forty-four hours, threads commence to show above the surface of the agar. No septa are visible and vacuoles are very few and far between.


The aerial threads bear gonidia in abundance, singly on short sterigmata, placed at right angles to the thread. These sterigmata are placed at short intervals, sometimes singly, sometimes in pairs, and sometimes in groups of three. See Fig. 18.

Hyphal Bodies—If the body of a *Lecanium*, affected with this parasite, be examined early in the course of the disease, before any growth has appeared on the surface, it will be seen to contain many hyphal bodies. Fig. 18. These are fusiform bodies, non-septate, containing granular protoplasm, and of varying size. Some of them are likely to be undergoing germination, putting out one or two slender, hyaline germ-tubes at one or both ends. These germ-tubes grow just as do those produced by the gonidia.

In studying this interesting form, one is at all times reminded of the early stages of *Cordyceps clavulata* (Schw.) Ellis. Both work on Coccidae of the genus *Lecanium*. *C. clavulata* passes through the flocculent stage described here but does not stop at that point, instead, it develops true Isaria sporophores, and later true Cordyceps heads with spores, at the apices of the Isaria sporophores, *lecanifera*, instead, stops at the first stage, producing no Isaria sporophores, so far as is known to the writer, and no perfect stage. The two species resemble each other very closely and differ only enough to make sure that they are not the same. Hyphal bodies, very similar in form, are found in the bodies of the affected insects, being septate in *C. clavulata* and non-septate in *lecanifera*. The gonidia are borne on flask-shaped sterigmata in both cases, being placed singly at intervals along the thread in *clavulata*, and in groups of two or three in *lecanifera*. The latter species grows much more freely in culture than *clavulata*, although both have yet refused to produce gonidia in agar agar.

THE MAPLE COTTONY PSEUDOCOCCUS.

Pseudococcus acericola King.

A coccid or scale-insect of more or less economic importance has been found this year, for the first time in our State. This new insect works on maples, and appears as white, cottony or mealy spots on the leaves. The insects spread rapidly, as is the case with most scale-insects, but are found in widely separated places. They are no doubt carried on the feet of birds, and as the females have legs and are capable of moving about all their lives (at least up to the time when the eggs are laid) this is easily done. The writer has found this insect twice, once an isolated colony at Ypsilanti, Mich., on a few trees, and once on a single tree at Ithaca, N. Y., in Six-Mile gorge. 

On May 2, 1902, the insects at Ypsilanti were all immature, crawling about or else secreted in the cracks of the bark, the young males being small and reddish-yellow in color, and the young females being yellow in color and slightly larger than the males. Soon after this the males spun small, oval cocoons and after a period, emerged. On June 24th, Mr. E. N. Colby kindly sent me another lot, this time of adult females in their niduses or egg-masses.

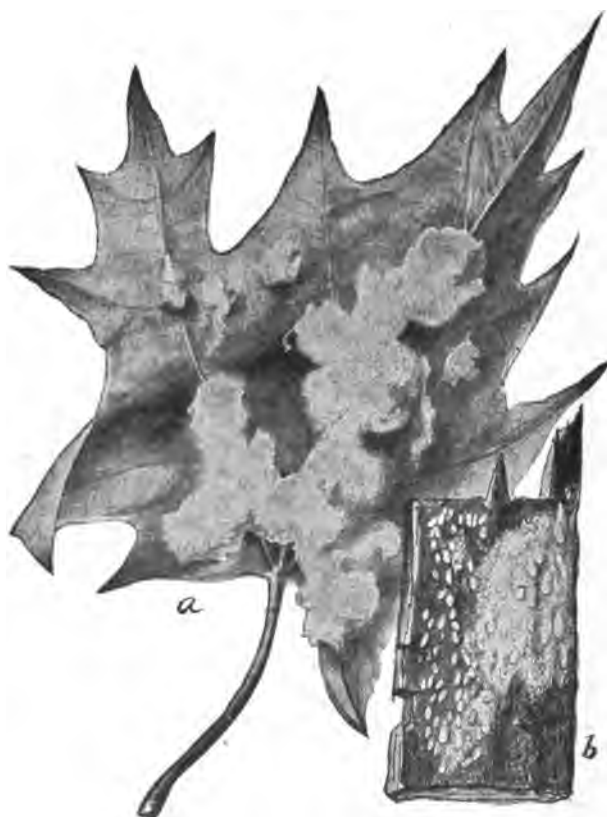


Fig. 19.—The maple cottony false mealy-bug, from Howard, *Insect Life*, U. S. Dept. of Agr.

The life-history of this insect was worked out by Miss Emily A. Smith, and published in "*North American Entomologist*," Vol. 1, p. 73, 1880. It was completed by Dr. L. O. Howard, in "*Insect Life*." Miss Smith credits the insect with raising three broods each year. They are said to migrate to the trunk of the tree, after reaching maturity on the leaves, and then to meet the males, after which they go back to the leaves to lay their eggs. Here they become conspicuous, owing to the dense mass of cottony matter that is pushed out to form the nest. All through these loose masses are found eggs, the females occupying places at the centers of the masses.

The female, on being boiled out in caustic potash, is found to be oval in form, from three to four millimeters long and perhaps two-thirds as

broad. It is almost destitute of hairs except at the cephalic end and on the sides. A moderate number of microscopic hairs are scattered over the body. Spinnerets are scattered over the back, being numerous at the caudal end. The legs are slender. The tibiae are two and one-half times (or slightly more) as long as the tarsi. The ano-genital ring is large, tuberculate, and bears six short hairs. The antenna is long and slender, being nine-jointed and bearing a few hairs. Joints eight and nine are closely united, sometimes appearing almost as one joint. Joint nine is longest; then come two and three, nearly as long; then

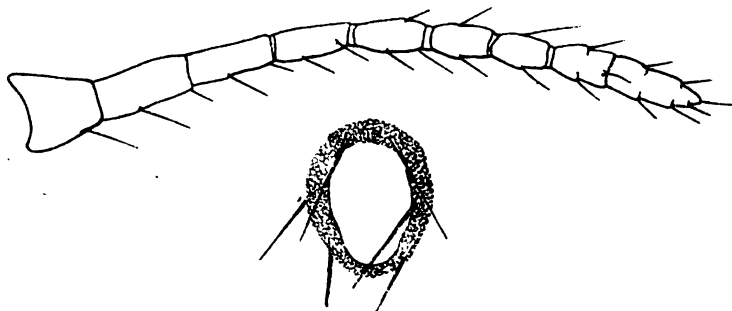


Fig. 20.—Antenna and ano-genital ring of female of the maple cottony false mealy-bug, enlarged Original.

one and four, then five, six, seven and eight. The relative lengths of the joints are somewhat variable, but the one given is fairly typical of the specimens collected.

The adult male has antennae with ten joints, a very short style, and four white anal filaments. Fig. 21. The middle two are long and the two outer ones shorter. The color is reddish-yellow to maroon. The wings are white.

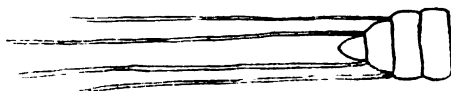


Fig. 21.—Anal filaments of male of maple cottony false mealy-bug, enlarged, Original.

The winter is passed in an immature condition in cracks in the bark and, at that time, they may be killed by means of the oily sprays.

Aphicus sp. and *Baccha fascipennis** were bred from the egg masses. As pointed out by Mr. King† and before him by Dr. Howard‡ the American species differs from that described by Signoret in several particulars. Mr. King's specimens differed from those of the writer in the relative lengths of the antennal joints, but otherwise they appeared to be the same. Signoret describes the female as oval, with the upper part of the back covered with hairs in the form of a punctulation, more or less dense, and with hairs very long, chiefly upon the median part of each segment, and at the extremity of the abdomen. The antennae are de-

* Kindly determined by Dr. L. O. Howard and Mr. Wm. Coquillett of the Department of Agriculture.

† Can. Ent. Vol. 31, p. 112.

‡ Insect Life, Vol. vii, pp. 235-240.

scribed as long, slender and of nine joints, the second and third being the longest, the others diminishing in size and length. The tibiae are three times as long as the tarsi. Our species is nearly naked except for microscopic hairs. The antennae vary a great deal so that they alone would not necessarily settle the matter. The tibiae are from two and one-half to two and three-fourths times as long as the tarsi in our specimens. The hairs on the back being the most striking difference. As Dr. Howard remarks, comparison with European specimens will be necessary before we are absolutely certain. At present it seems best to use the specific name proposed by Mr. King. The old genus *Pseudococcus* is retained as there seems no sufficient reason for the change to *Phenacoccus* as has been proposed. *Pseudococcus* is a well known genus which has, at the present time, no rival with claims of priority. It seems hardly worth while to propose a new name because the two first species included by Westwood under the genus *Pseudococcus* were later found to belong elsewhere. Signoret used the genus and since that time it has come to be well known.

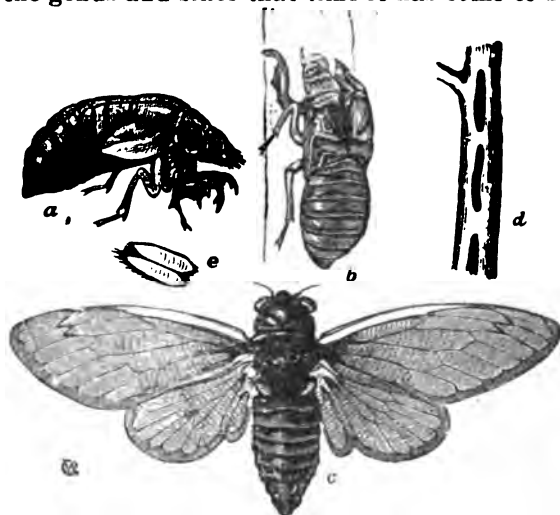


Fig. 22.—Periodical cicada, from Packard, Forest Insects, U. S. Ent. Com.

THE PERIODICAL CICADA.

Cicada septendecem.

The past summer has witnessed the coming of the seventeen-year cicada or the seventeen-year locust, so-called, an interesting insect which passes the long period of seventeen years under the surface of the soil in preparation for a few weeks or days of residence in the open air.

Commencing with the emergence of the adult, winged insect, the life history is as follows: Early in June, in Michigan, the pupa (which is in the last stage before maturity) burrows up out of the ground and climbs upon some tree or other support ready to shed its skin. This usually occurs on some warm evening. After a little, the pupa skin splits down the back and slowly the adult draws its body out, remaining for a time to dry itself, and expanding its wings. Usually many are im-

pelled to come to the upper world at the same time. The life of the mature insect lasts but a short time, a week or so. The eggs are laid, and all is over. By the first part of July the insects are gone in Michigan. The eggs are deposited in the branches of trees, in holes bored by the ovipositor of the female. See fig. 22. Right here all the damage, if any, is done. The numerous holes in the twigs kill a few of them, but at most, it can only amount to a severe pruning from which the tree usually recovers quickly. The larvae from the eggs fall to the ground and burrow out of sight. Now commences the long underground existence, during which they feed on the roots of trees. The places frequented are usually woodland or land that was wooded originally. Owing to the large areas cleared in recent years, the number of cicadas is steadily decreasing.

Curiously enough, the entire area in the United States inhabited by these insects, may be divided into two regions, a northern and a southern, which regions slightly overlap. The southern region is inhabited by a race which occupies thirteen years in development, while the northern region supports a race requiring seventeen years.

The entire number of seventeen-year cicadas is divided into twenty-two broods, each of which emerges at a well-known time and occupies a well-defined area. Michigan is visited by three of these broods and possibly by a fourth. The broods for 1902, 1905 and 1911 visit Michigan, and possibly the one for 1898.

The last brood, the one for 1902, occurred at Battle Creek, Kalamazoo, Ann Arbor, Ypsilanti, Adamsville, Bitely, Flint, Birmingham, and questionably at Moorestown. Several of these records were obtained for me through the kindness of Director C. F. Schneider of the weather bureau.

The song of the cicada is very characteristic. It is produced by a pair of small organs on the first abdominal segments. The tone is shrill and not unlike the sound of a distant mower; when many are singing together, the sound may become monotonous. The bite of the cicada seems to be rarely experienced. Many newspaper accounts would lead one to regard the harmless insect with fear. The writer observed a single case. While handling and examining a number, the lady in question received a sharp thrust from the beak of one. The pain was no greater than would have been inflicted with a needle, and this quickly passed away without returning.

A fungus disease *Massospora cicadina*, was observed to be common at Ann Arbor and vicinity. The fungus absorbs the tissues of the living insect without seeming seriously to interfere with its comfort. Many adults were seen walking about without the apical part of the abdomen and occasionally one with the whole abdomen gone.

No damage was reported during the last outbreak in Michigan. There is little to fear, unless a young orchard has just been set out on land previously wooded, and where the insect has been seen in the past.

THE ANGOUMOIS GRAIN MOTH.

(*Sitotroga cerealella*.*)

Nearly two hundred years ago an interesting insect was, in some way, introduced from France into North Carolina. Here it became acclimated

*Kindly determined for me by Miss Mary E. Murtfeldt and by Mr. Busck of the Department of Agriculture.

and made its presence known by the destruction of large amounts of grain.

Since that time the invader has steadily spread north and south and has now reached Michigan. In the South it is rated as the most destructive enemy to stored grain with which they have to deal. It works on wheat, oats, corn and all the other grains.

Fig. 23 shows all the stages of the insect. The pest works both in the field and in the granary, developing from four to eight broods each year. The adult winged moth looks very much like a clothes-moth, the wings being narrow and measuring about half an inch or less from tip to tip. In color the moths are buff or yellowish-white, marked with a little dark brown or black. It is said to go to the field from the granary about the time that the wheat heads out. Here the eggs are laid in numbers. Another brood of adult moths develops about harvest time and the eggs and young larvae from this lot go to the granary. Here they

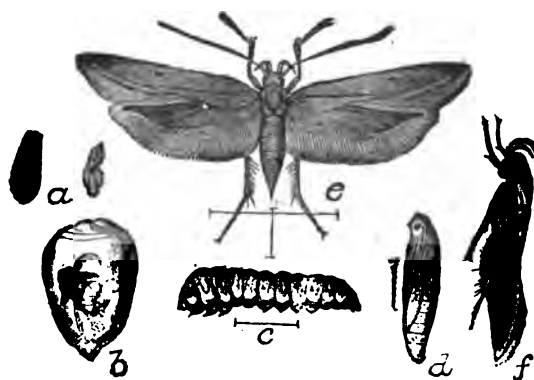


Fig. 23 - Angoumois grain-moth, from F. H. Chittenden, U. S. Department of Agriculture, *Farmers' Bulletin*, No. 45.

feed on the inside of the kernel and produce another brood during the latter part of September. Eggs are laid on fresh grain, and the number of succeeding broods depends on the weather, there may be one or several. Working, as it does, on the inside of the kernel, it is easily overlooked. The outside shell is left unharmed, except for the small hole through which the adult moth escapes.

Beside losing in weight, the grain is often injured for milling purposes, beside being distasteful to horses. Professor John B. Smith recommends that threshing be done as soon after harvest as possible and that the grain be put in bulk in tight bins or sacks. If the grain heats more than usual, it may be an indication that the larvae are at work. In such cases it is well to treat with carbon bisulphide, using the liquid at the rate of one pound to 100 cubic feet of air space in the bin, sometimes more is needed, especially if the weather be cold.

In using carbon bisulphide, always remember that the gas which arises from the liquid is the killing agent, and remember that this gas is poisonous if breathed and very explosive if ignited. For these reasons have everything ready before pouring out the liquid. The capacity of the bin should be measured, including the air space above the grain as well as the grain itself; shallow pans or plates should be placed on top

of the grain and the covering should be made ready so that the bin can be quickly closed. The bin must be made tight in the first place. Paper pasted or tacked on the inside will help greatly to close up cracks and crannies. When all is made ready, pour in the liquid and close the bin, breathing as little as may be of the fumes, and being careful to do it all in the absence of fire. The bin should be opened after twenty-four hours and the grain should then be aired, after which the bin should be kept tightly closed to prevent future infestation.

THE BANDED PURPLE BUTTERFLY.

(*Basilarchia arthemis*.)

Strange as it may seem, we have to record injury done young apple trees by one of the most beautiful butterflies in the country, the Banded



Fig. 24. — Folded leaves or hibernaculi in which the small larvae of the Banded Purple butterfly pass the winter, enlarged. Original.

Purple (*Basilarchia arthemis*). In only one location, and under peculiar circumstances, was the injury done. In the central part of the Upper Peninsula, few apple trees exist, and there this butterfly feeds in its immature condition, on wild foliage. An attempt to set out a young orchard at Chatham, on the sub-station grounds, was followed by an attack by this insect. Later, when the trees become partially grown, the tax levied by the larvae of this butterfly, will not be noticeable.

The life history of this insect differs slightly from that of most of our species. Instead of passing the winter in the adult, or in the pupal condition, as most butterflies do, this insect, in common with others of its genus, builds a retreat or hibernaculum out of the base of a leaf bound up with silk, and passes the winter therein while still very small. Fig. 24 shows several such hibernaculi considerably enlarged.

Specimens of the hibernaculi were received from Mr. Leo Geismar, Superintendent of the sub-station at Chatham, who writes that they were very numerous indeed on the young apple trees. They were controlled by hand picking in this case, although the ordinary spray of paris green, applied before the buds opened, would have killed the young larvae. Mr. Geismar wrote that the larvae attacked the buds almost before they opened, later feeding on the foliage.



Fig. 25.—Banded Purple butterfly, nat. size, Original.

THE HICKORY BARK-BEETLE.

(*Scolytus 4-spinosus*.)

About the middle of August, the writer, in company with Prof. C. F. Wheeler, visited Belle Isle park of Detroit, at the request of Mr. M. P. Hurlbut, Secretary of the Commission of Parks and Boulevards. The trouble was due to a small beetle found by Mr. Alexander to be working in the twigs in the new growth of the shag-bark hickory (*Hicoria ovata*), and the pignut hickory (*H. glabra*). The damage to the twig is caused by the boring of a hole just inside the petiole of the leaf, where it joins the twig. This usually kills the bud, and the insect usually bores into the new growth often killing that also, almost invariably doing so if the work is done just below the terminal bud.

Professor Wheeler, after an examination of the branches, decided that almost all the injury had been done during the last three years, a little work showed as the result of injury done four years ago.

The work of this insect is quite conspicuous even at a distance, the large leaves at the tips of the twigs being dead and discolored. On opening the tunnels in some of the twigs, beetles, belonging to the family of bark-beetle, or Scolytidae, were found*. This lead to an examination of the bark, which was found to be pitted with small, round holes. On removing the bark in the vicinity of these holes, the brood chambers with the radiating tunnels leading from them were found. Most of the brood chambers seemed to be completed at this time, and, in many cases, the dead beetles were found in the openings. Such beetles were short semi-cylindrical creatures, about three-sixteenths of an inch in length, polished and black, except for the wing-covers, which were, in some cases, dark brown.

*This insect was kindly determined for me by Mr. T. Chittenden, of the Department of Agriculture at Washington, D. C.

It is well known that all trees do better under natural conditions than under artificial ones. We have all noticed the lack of health among the trees in slashings, where many of the trees have been cut and where the grass has taken possession and sodded the ground. The trees are never so healthy in such places. The general vitality of the trees is weakened and then the borers come, especially the bark-beetles. These insects



Fig. 26—Tunnels of hickory bark-beetle in bark, nat. size, Original.

always select sickly trees, if any such are present. Parks are always more or less unnatural. It is not possible to preserve the loose, leafy covering for the soil, the surface becomes packed and in many places sodded, and where many trees are living close together, a disease spreads easily from one to another.

In cases like the present, where bark-beetles are at work, the only method known is to cut out such trees as are being used for breeding places. This does not include those whose twigs alone are affected, but those containing chambers under the bark. This should be done to cut off the supply of beetles in the hope of checking the trouble. The trees should be stimulated if possible in order to keep them in perfect health and in a condition distasteful to the beetles.

SUGAR BEETS IN THE UPPER PENINSULA.

C. D. SMITH DIRECTOR, AND SUPERINTENDENT L. M. GEISMAR.

Special Bulletin No. 18.

The map of the so-called "Sugar Beet Belt," as published in 1896, includes less than the south half of the Lower Peninsula of Michigan. "Farmers' Bulletin, No. 52," in which it is contained, states: "Experience has shown that the sugar beet reaches its highest development in north temperate latitudes. So far as the production of beets with high tonnage is concerned, it is found that this can be accomplished far to the south, but beets grown in such localities are, upon the whole, less rich in sugar and less suitable to the manufacture of sugar than those grown farther north."

The sugar beet belt is determined as a zone of varying width, through the center of which passes the isothermal line of seventy degrees for the months of June, July and August; the city of Lansing being the most northern point in the belt in Michigan and the belt being more fully described:

"Extending a distance of one hundred miles on each side of this isothermal line is a belt which, for the present, may be regarded as the theoretical beet sugar area of the United States. There are doubtless many localities lying outside of this belt, both north and south, in which the sugar beet will be found to thrive, but this will be due to some exceptional qualities of the climate or soil, and not to any favorable influence of a higher or lower temperature."

Later investigations of the Department of Agriculture at Washington led to material changes in the theoretical map of the sugar beet belt. It was found that areas well adapted to the economical production of beets were found well outside the belt bounded by lines drawn parallel to the isotherm of seventy degrees for the summer months and 100 miles distant from it. It was also found that conditions other than summer temperature must be considered in this connection. The revised map of 1897, for instance, extended the northern limit of the beet belt in Michigan northward to a line drawn east and west through Iosco and Benzie counties.

In a bulletin issued by the National Department of Agriculture in 1899, entitled "Progress of the Beet Sugar Industry in the United States in 1898," page 133, Dr. H. W. Wiley, chemist of the department, says: "North of the limit of the belt, however, the extension of the culture of the beet can be pushed just as far as the climate will permit the ripening of the crop and the harvesting and the care thereof before the freezing of winter sets in. Our experience in this country has shown that the farther north, other things being equal, beet culture is practiced, the better the quality of the beets produced. This is due to the fact that by reason of the longer days which are secured by going farther north, the activity of the chlorophyll cells of the beet leaves, in which, under the influence of light and heat, the sugar is elaborated, is increased and extended, so that

more sugar can be made for a given leaf surface than farther south. In addition to this, the lower temperature seems to favor the elaboration and accumulation of the sugar. Thus the general principle may be enunciated that the areas of successful beet culture will extend as far northward as the climate will permit the proper ripening and harvesting of the crop."

In Bulletin 64, Bureau of Chemistry, Department of Agriculture, page 30, it is stated: "It is evident that the elements of sunlight, which are active in promoting the action of the chlorophyll cells in the formation of sugar, do not depend upon the direct rays of the sun. The diffused light coming through the clouds is apparently quite as effective as the direct light."

As bearing upon the richness of the beets grown in the Upper Peninsula, the following table, which records the hours when the sun is above the horizon in the six months beginning April 15 and ending October 15, in latitudes 42, 43 and 47 degrees, is submitted:

	Number of hours in which the sun is above horizon.		
	Latitude 42	Latitude 43	Latitude 47
April 15 to 30	218 91	219 63	224 14
May	451 95	454 81	467 36
June	456 12	459 66	475 70
July	461 87	465 40	479 65
August	429 53	431 36	440 08
September	374 47	375 09	376 93
October to 15	171 37	171 07	169 49
Totals	2,564 22	2,577 02	2,633 35

Excess of sunlight in 47 over 43 is 56.33 hours.

Excess of sunlight in 47 over 42 is 69.13 hours.

The latitude of Coldwater, Hillsdale and Adrian is approximately 42.

The latitude of Port Huron and Grand Rapids is approximately 43.

The latitude of Houghton is slightly over 47.

It is inevitable that this very notable excess of sunlight in the Northern Peninsula must exercise a dominant influence on the percentage of sugar in the beets grown there, as compared with those grown in Southern Michigan.

In the spring of 1902 sugar beet seed was distributed through the several counties of the Upper Peninsula to farmers who were known to be so situated as to be able to care for plots of beets and to report the results to the Station. The following varieties were used in the test:

No. 1 Hoerning's Improved Kleinwanzlebener Special Elite.

No. 2 Dippe's Elite Kleinwanzlebener.

No. 3 Strandes Kleinwanzlebener.

No. 4 Vilmorin French Very Rich.

No. 5 Sachs' Kleinwanzlebener.

In the tables to follow, the varieties will be referred to by number as above. Numbers 1, 2, 3 and 4 were donated to the station by the Department of Agriculture, Washington, D. C. No. 5 was purchased of the Lansing Sugar Co.

The seed was sent out early in May and was nearly all planted before the first of June. The plots were necessarily very small and no reports will be made of the tonnage. The rows were, in most cases, eighteen inches apart, the thinning was done between the middle of June and the fifteenth of July. The culture was largely by hand and consisted of hoeing frequently enough to keep down the weeds. The harvesting occurred in late October and early November. The season was rather dry for the upper peninsula, a full report of the rainfall appearing in a bulletin soon to issue, and to be had on application to the Secretary, Agricultural College, Mich.

The soil varied from a sandy to a clay loam, with no samples from muck.

At the time of harvest, typical samples were sent to the College for analysis. These samples were inclosed in cloth sacks and, owing to the long distance traveled, were more than two days, and often more than three days on the road. They dried out very perceptibly in this journey so that figures given below are all too high to express the amount of sugar in the beet at the time it was pulled from the ground.

F. W. Robison, the chemist of the Station, undertook to secure some data as to the amount of this loss of water in transit.

Samples of beets were subjected to conditions similar to those surrounding the beets sent to the College from the upper peninsula and for a like period of time, namely three days. It is, of course, impossible to discover how long the beets sent for analysis were pulled before shipment nor to what conditions they were subjected. It was, therefore, impossible to imitate those conditions. In this test, therefore, the samples of beets were kept in the laboratory or in an office for three days and were analyzed, with the following results:

Sample.	Original weight. grains.	Weight after 3 days. grains.	Loss of weight. %	Sugar in juice on analysis.	Sugar in juice as harvested
1	734.8	582.5	20.7	18.6	14.68
2	466.9	388.5	16.8	20	16.6
3	457.5	358.5	21.6	20.9	16.4
4	361.6	287.5	20.4	20	15.9

The drying out of the beets in shipment is, therefore, a very important factor, and the results reported in the table following must be considered with this fact in mind.

The following tables report the analyses of beets grown in the Upper Peninsula in 1902. After the name of the grower, the figure refers to the variety by number, as given in the table above; next follows a column reporting the per cent of sugar in beets as they arrived at the College. The last column gives the purity of the juice or the per cent of sugar in the total solids dissolved in the juice:

BEETS GROWN IN UPPER PENINSULA IN 1902.

ALGER COUNTY.

Grower.	Variety.	Per cent sugar in juice.	Purity-Per cent sugar in beet.
Ella M. Cox.....		11.9	89.
Martin Heim.....	5	12.4	72.6
Mrs. L. Anderson.....	5	14.5	89.8
Ex. Station.....	5	14.2	79.9
Ex. Station.....	2	14.2	79.
Average		13.4	82.

BARAGA COUNTY.

Aug. Gardberg.....	5	15.9	76.0
Hokan Lindin.....	5	15.0	68.3
C. P. Blankeston.....	5	16.0	87.8
John Krohlich.....	3	16.1	80.8
John Milson.....	5	17.0	88.5
James Jackson.....	5	15.5	78.6
Alex. G. Shields.....	5	16.3	85.
John Peterson.....	5	16.7	89.2
Aug. Paulson.....	5	15.5	85.5
Aug. Polder.....	5	16.9	85.
Alf. Peterson.....	5	15.0	85.4
Peter Newman.....	5	17.7	82.3
John Falk.....	3	14.6	89.4
Ed. Olson.....	5	16.8	85.
J. B. Belanger.....	5	15.2	82.2
Steven Scranton.....	5	15.4	83.2
Stactes Scranton.....	5	15.6	80.2
Charles Wadega.....	5	14.8	81.2
Average		15.9	82.8

CHIPPEWA COUNTY.

C. B. Steele.....		16.3	84.7
James J. Browner.....	5	12.3	81.2
E. N. Baldorf.....	5	13.9	84.
James Story.....	4	14.2	82.7
William Brimsdon.....	1	15.8	86.3
William H. Caldwell.....	2	16.7	92.0
Chris. Weinreich.....	1	14.4	83.5
Leonard McDowell.....	1	13.2	85.7
Thomas Cummins.....		11.1	81.8
William Donnelly.....		17.2	85.4
John Atkin.....		16.9	83.6

STATE BOARD OF AGRICULTURE.

CHIPPEWA COUNTY—CONTINUED:

Grower.	Variety.	Per cent sugar in juice.	Purity—Per cent sugar in beet.
Jerry Bergeron.....	5	14.7	80.
Lewis Potwin.....	5	13.8	76.1
Hiram McDowell.....	1	15.1	81.3
W. H. Downman.....	5	15.7	91.
Albert Ichman.....	5	14.2	91.
L. D. Burchild.....	5	12.6	79.8
R. J. Tallis.....		16.0	81.6
Greg Ziegler.....	2	15.8	77.1
William Wilson.....	2	15.1	82.9
Walter Todd.....	5	17.1	86.9
M. Ziegler.....	2	17.9	91.1
Wesley Mine.....	5	15.0	81.1
Alex. Morrison.....	5	17.1	93.0
Thomas Hughes.....	3	16.5	84.5
Newman Brimsdon.....	1	16.8	88.8
J. O. Neall.....	4	14.2	79.0
Geo. Cummings.....	5	15.7	85.5
John J. Buck.....	1	18.6	81.9
Martin Francis.....	5	19.2	86.4
James Duncan.....	5	15.3	87.5
D. K. Brown.....	5	15.4	86.6
James McDonald.....	5	16.9	79.1
William Coleman.....	4	12.7	79.8
R. G. Trimble.....	1	13.7	81.9
Mark Scott.....	2	15.6	80.0
W. Howlett.....		15.3	81.0
Average		15.3	83.9

DELTA COUNTY.

Geo. Fuhlman.....	4	14.8	81.0
Geo. Damit.....	4	13.3	79.2
Carl Zerbel.....	5	14.6	86.4
Adam Rice.....	5	15.4	84.
Aug. Schram.....	4	17.4	91.3
Herman Johnson.....	5	15.4	84.8
Daniel Kelly.....	5	14.8	81.0
John Wilson.....		14.9	63.6
Werner Bietzke.....	4	14.8	87.1
C. D. Johnson.....		18.2	92.8
Geo. Finday.....	4	15.0	94.8
A. Schultz.....	4	13.8	84.4
William Bietzke.....	4	15.4	86.6
E. E. Little.....	5	16.0	87.8
Herman Throhel.....	4	16.2	86.3
John Hocks.....	4	13.8	84.7
Henry Johnke.....	4	13.9	81.7
John Sexton.....	1	17.5	88.8
John Martin.....	5	17.3	90.8
Robert Adams.....	5	18.0	89.9
Martin Rivers.....	1	18.3	90.9

DELTA COUNTY—CONTINUED.

Grower.	Variety.	Per cent sugar in juice.	Purity—Per cent sugar in beet.
Fred Craty.....	5	16.0	87.0
Will Young.....	4	14.6	93.7
Joe Shult.....	4	13.6	85.5
G. Schedin.....		16.0	84.9
F. J. Streeter.....	5	23.0	87.6
W. T. Dillabaugh.....	5	13.1	77.0
Frank Burchikowsky.....	5	13.8	82.5
Frank Roberts.....	5	18.3	86.5
Geo. Wilsie.....	5	15.4	80.0
James Nelson.....		17.0	84.1
John Wickstrom.....	5	15.9	82.3
Ole Johnson.....		16.1	80.3
Jacob Barboo.....	4	14.2	79.0
Pat. Pural.....	5	13.6	74.9
Average		15.70	81.75

DICKINSON COUNTY.

Alfred Nicholson.....	5	14.8	81.7
Louis Sonaghia.....	3	13.4	80.7
Average		14.1	81.2

HOUGHTON COUNTY.

L. Gillispie.....	5	18.0	86.8
Frank White.....	5	18.6	89.5
John Powroy.....	5	14.4	68.8
J. W. Alston.....	3	16.3	86.4
Fred A. Larson.....		18.0	87.5
Ernest Fisher.....	5	19.6	84.29
P. G. Baumgartner.....		17.0	86.4
Average		17.4	84.21

IRON COUNTY.

Charles Eoits.....	5	14.4	87.7
C. P. Campbell.....	5	15.7	85.1
Average		15.0	86.4

LUCE COUNTY.

Levi Miller.....	5	17.11	92.0
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MACKINAC COUNTY.

A. H. Bowman.....	3	14.0	78.0
John Langstaff.....	2	18.2	94.2
F. J. Silmitz.....	2	17.1	85.0
J. D. Erskin.....	2	17.0	85.2

STATE BOARD OF AGRICULTURE.

MACKINAC COUNTY—CONTINUED.

Grower.	Variety.	Per cent sugar in juice.	Purity-Per cent sugar in beet.
Aug. Silmitz.....	2	13.6	78.3
R. Gillispie.....	3	17.2	85.1
John McGrath.....	3	17.7	84.0
A. McEacheron.....	3	17.6	86.3
Average		16.55	84.51

MARQUETTE COUNTY.

J. S. Wood.....		13.6	77.9
Theodore Huebner.....	5	14.6	88.4
E. O. Setter.....	5	15.0	85.9
Amedee Deshares.....	5	13.6	84.6
Basil Baby.....	5	15.8	87.3
William Herring.....	5	13.8	81.1
William Zerbel.....	5	13.3	79.7
Peter White	5	13.2	74.7
Peter White.....	5	13.0	79.7
Peter White.....	5	12.6	
Average		13.85	80.67

MENOMINEE COUNTY.

Otto Schwartz.....	5	14.8	91.0
John B. Anderson.....	5	17.0	82.9
S. Crawford.....	5	14.2	83.8
John Levitz.....	5	15.5	88.5
L Dobeas	5	17.3	90.0
Walter Delarmo.....		16.7	90.0
L. Longhurst.....	5	15.6	87.6
Geo. M. Smith.....	5	17.5	89.1
Ira Carley.....	3	15.2	81.3
Ira Carley.....	5	16.8	85.0
Ira Carley.....	5	17.3	84.4
Patrick Sears.....	5	16.3	89.8
C. B. Springer.....	5	16.3	91.9
C. B. Springer.....	5	15.5	91.8
M. Nelson.....	5	18.2	90.7
M. Nelson.....	5	19.4	85.0
Ira Carley.....	5	18.6	80.3
Average		16.6	88.3

ONTONAGON COUNTY.

William Lain.....	5	12.4	82.8
Edward Ryan.....	5	15.1	81.6
Geo. L. Emery.....	5	17.3	94.5
Rudolph Stindt.....	5	13.8	80.6
James Howlett.....	5	16.5	88.7
Average		15.0	85.64

SCHOOLCRAFT COUNTY.

Grower	Variety.	Per cent sugar in juice.	Purity-Per cent sugar in beet.
M. Grunrood.....	5	10.4	74.0
John Devroy.....	5	15.7	85.5
Peter Peterson.....	5	14.6	82.4
Earl Ford.....	5	18.0	89.1
Samuel T. White.....	5	16.3	86.4
Nathan N. Hutchinson.....	5	15.9	91.0
Average		15.16	84.7

SUMMARY.

County.	No. of samples.	Average per cent of sugar in beets.	Average purity.
Alger	5	13.4	82.
Baraga	18	15.9	82.8
Chippewa	37	15.3	83.9
Delta	35	15.7	81.75
Dickinson	2	14.1	81.2
Houghton	7	17.4	84.21
Iron	2	15.	86.4
Luce	1	17.11	92.
Mackinac	8	16.55	84.57
Marquette	10	13.85	80.67
Menominee	17	16.6	86.3
Ontonagon	5	15.0	85.64
Schoolcraft	6	15.16	84.7

The men who grew these beets were inexperienced and most of them made the mistake of pulling them too green. The purity is low and the per cent of sugar is much lower than it would have been had the beets been left in the ground until fully ripe.

No conclusion can be drawn from the results of the work of a single season either as to the per cent of sugar and purity that may be expected from beets grown under the climatic conditions obtaining in the Upper Peninsula, nor as to the adaptation of the business of growing beets and making sugar therefrom to that great section of the State.

SPRAYING CALENDAR.

Special Bulletin No. 19.—Horticultural Department.

Whenever an asterisk (*) is used, it cautions against spraying trees with poisons while they are in blossom.

† For the San Jose scale upon apple and other trees use the sulphur, lime and salt mixture. When upon small trees, kerosene may be applied with an atomizer.

Farmers and fruit growers are beginning to understand the importance of the use of insecticides and fungicides to preserve their crops from the attacks of insects and diseases. To supply information as to the best remedies and the methods of preparing and using them, in a form that can be preserved so as to be convenient for reference, the following bulletin has been prepared. The remedies have been thoroughly tested, and if the directions regarding their preparation and application are carefully followed, they will be found effectual and can be used without danger to the foliage and fruit, or the health of the consumer.

EXPLANATION: While the entire number of applications given will be found desirable in seasons when insects and fungous diseases are particularly troublesome, and in the case of varieties that are subject to attack, a smaller number will often suffice. To indicate those that are of greatest importance, italics have been used, while others, that, although seldom required, may sometimes be of value, are printed in plain type.

APPLE.

(Scab, codling moth, bud moth, canker worm, tent caterpillar, aphis.)

First Application.—Spray before buds start, using copper sulphate solution. *For aphs use kerosene and water mixture.†*

Second Application.—*After the blossoms have formed but before they open, spray with Bordeaux mixture and Paris green.**

Third Application.—*Within a week after the blossoms fall, Bordeaux and Paris green.**

Fourth Application.—Ten to fourteen days later, Bordeaux and Paris green.

Fifth Application.—*Spray fall and winter varieties with Bordeaux and Paris green about the first of August.*

(NOTE.—For the oyster-shell scale on the apple, spray with lime white-wash and lye after the leaves drop.)

CABBAGE.

(Worms, aphs and flea beetle.)

First Application.—*When worms are first seen, Paris green. For flea beetles, plaster and turpentine, or tobacco dust.*

Second Application.—*If worms reappear, repeat if plants are not heading.*

Third Application.—*After heads form, use hot water, pyrethrum, or saltpeter (a teaspoonful to a gallon water).*

Fourth Application.—Repeat if worms reappear. For aphs use kerosene and water mixture.

CHERRY.

(Rot, aphs, curculio, slug and leaf blight.)

First Application.—*Before the buds open spray with copper sulphate; for the aphs use kerosene emulsion, or kerosene and water mixture.†*

Second Application.—*When the fruit has set, spray with Bordeaux mixture and Paris green.**

Third Application.—Ten to fourteen days later, if slugs or signs of rot appear, repeat.

Fourth Application.—Ten to fourteen days later, weak copper sulphate solution if necessary.

CURRENT.

(Mildew, worms, borers and leaf blight.)

First Application.—*When pruning cut out all stems that contain borers. As soon as worms are found on lower and inner leaves, spray with Paris green.†*

Second Application.—*If worms reappear, repeat, adding Bordeaux for mildew and leaf spot.*

Third Application.—*If worms still trouble, pyrethrum or hellebore.*

Fourth Application.—*After fruit is picked, Bordeaux for leaf spot.*

GOOSEBERRY.

(Mildew, leaf blight and worms.)

First Application.—*As leaves open, Bordeaux and Paris green.†*

Second Application.—*In ten to fourteen days repeat with both.*

Third Application.—*Ten to fourteen days later use sulphide of potassium on English varieties.*

Fourth Application.—*Ten to fourteen days later repeat.*

Fifth Application.—*If mildew persists after crop is gathered, repeat.*

GRAPE.

(Rot, mildew, anthracnose, flea beetle and leaf hopper.)

First Application.—*Before buds burst, spray with copper sulphate solution. Add Paris green for leaf beetles.*

Second Application.—*When first leaves are half grown, Bordeaux and Paris green. For leaf hoppers use kerosene and water mixture.*

Third Application.—*When fruit is set use Bordeaux and Paris green.*

Fourth Application.—*Repeat if necessary at intervals of ten to fourteen days.*

Fifth Application.—*For powdery mildew use sulphide of potassium.*

PEACH, APRICOT.

(Leaf curl, curculio, mildew and rot.)

First Application.—*Before April 1, spray with copper sulphate solution.†*

Second Application.—*When fruit has set, use Bordeaux mixture and Paris green, two-thirds strength.*

Third Application.—*Ten to fourteen days later repeat.*

Fourth Application.—*If rot appears, use weak copper sulphate solution.*

Fifth Application.—*Repeat if necessary.*

PEAR.

(Leaf blight, scab, slug and codling moth.)

First Application.—*Before buds open, copper sulphate solution.†*

Second Application.—*When the blossoms have formed, but before they open. Bordeaux and Paris green.*

Third Application.—*Within a week after the blossoms fall, Bordeaux and Paris green.**

Fourth Application.—*Repeat in ten or twelve days, if necessary.*

Fifth Application.—*Use weak copper sulphate solution, if necessary.*

PLUM.

(Curculio, rot, shot-hole fungus, black knot.)

First Application.—*Cut and burn black knots whenever found. Before buds open, spray with copper sulphate solution.*†

Second Application.—*As soon as the blossoms have fallen, use Bordeaux mixture and Paris green.*

Third Application.—*Ten to fourteen days later, repeat.*

Fourth Application.—*Repeat if necessary, at intervals of fifteen to twenty days.*

Fifth Application.—*After fruit begins to color, use weak copper sulphate solution should rot appear.*

POTATO.

(Blight, beetles and scab.)

First Application.—*Soak seed for scab in corrosive sublimate (two ounces to sixteen gallons of water), for ninety minutes.*

Second Application.—*When beetles or their larvae appear, Paris green in lime water, or Bordeaux mixture.*

Third Application.—*Repeat whenever necessary.*

Fourth Application.—*For leaf blight use Bordeaux.*

Fifth Application.—*Repeat in ten days if necessary.*

QUINCE.

(Leaf and fruit spots, slug.)

First Application.—*Before the buds open, spray with copper sulphate.*†

Second Application.—*When the fruit has set, Bordeaux and Paris green.*

Third Application.—*Ten to twelve days later, repeat.*

Fourth Application.—*Ten to twenty days later, Bordeaux.*

RASPBERRY, BLACKBERRY.

(Anthracnose, rust, cricket, slug and galls.)

First Application.—*Cut out galls, crickets and canes badly diseased with anthracnose. Before buds open, spray with copper sulphate solution.*

Second Application.—*When new canes are one foot high, Bordeaux and Paris green.*

Third Application.—*Ten to fourteen days later, repeat.*

Fourth Application.—*After crop is gathered remove old canes, thin new ones and spray with Bordeaux if necessary.*

(NOTE.—If red rust appears the entire stool affected should be grubbed out and

STRAWBERRY.

(Rust and leaf-eating insects.)

First Application.—*Just before the blossoms open, Bordeaux and Paris green.*

Second Application.—*After the fruit has set use weak copper sulphate solution.*

Third Application.—*As soon as berries are harvested, Bordeaux (if to be kept longer).*

(NOTE.—Young plantations should receive first and third treatments given to bearing plants.)

(After harvesting mow and burn over the bed, especially if leaf rollers are found.)

TOMATO.

(Rot and blight.)

First Application.—*If either disease appears, Bordeaux.*

Second Application.—*Repeat if disease continues.*

Third Application.—*Repeat if necessary.*

FORMULAS.

Bordeaux Mixture.

Copper Sulphate	4 pounds
Fresh Lime (unslaked)	4 pounds
Water	40 gallons

Care should be taken that the lime is of good quality and well burned and that it has not become air-slaked. If only a small amount is to be slaked it will be best to use boiling water, and the lime should not be allowed to become dry while slaking. When much Bordeaux is to be prepared, it is a good plan to make up stock solutions which can be mixed as required, proceeding as follows: Dissolve 40 pounds of copper sulphate in 40 gallons of water and in a box slake 40 or more pounds of lime. These can be kept for some time, but it is best not to prepare more than can be used in a week or ten days. Each gallon of the solution will contain one pound of the copper sulphate, and in preparing it for spraying, as many gallons should be used as are necessary to furnish the proper amount of copper sulphate. Thus for each 40 gallons required, four gallons of the solution should be placed in a barrel in which there are 16 gallons of water. An equal weight of lime, as near as can be estimated, should be placed in another barrel and 20 gallons of water added to this. After being well stirred, the lime mixture should be allowed to stand for a minute to give the coarse particles time to settle, and then the lime water should be dipped out and slowly poured into the copper sulphate solution, stirring rapidly as the lime water is poured in. The mixture is then ready for use, but, as there is danger of burning tender foliage if the amount of lime is insufficient, it is well to use some simple test, such as dipping a knife blade in the mixture, or adding a few drops of ferro-cyanide of potassium (yellow prussiate of potash). If the amount of lime is not sufficient, copper will be deposited upon the knife blade, while the ferro-cyanide of potassium will give the mixture a deep brownish-red color. More lime should be added if necessary until no discoloration is caused in either case. A slight excess of lime will do no harm and is always desirable.

The copper sulphate can be easily dissolved, if suspended in the water in a coarse sack or basket. If the lime is properly slaked and is handled as recommended, there will be little trouble from lumps, but it is always well to strain the lime-water through a sieve, such as a piece of window screening.

This is the best remedy for fungous diseases except while the trees are dormant, or as the fruit is ripening. It is especially valuable for use with Paris green and other arsenites, as it lessens the danger of their injuring the foliage and the washing effect of rains.

Copper Sulphate Solution.

Copper Sulphate	1 pound
Water	25-50 gallons

For use before the buds open the above solution is fully as effectual as Bordeaux mixture and is easier to prepare and apply, but it should not be applied to any plant after the buds have opened. For use against the

leaf curl of the peach this solution is especially desirable. If used before the middle of April a thorough application will entirely prevent the attack.

Weak Copper Sulphate Solution.

Copper Sulphate	1 pound
Water	200-400 gallons

A solution of copper sulphate of this strength can be used with safety upon nearly all plants. The stronger solution can be used upon all fruit trees except the peach, for which a weak solution would be preferable. Although less effective than Bordeaux mixture, the weak solutions of copper sulphate may be used to advantage where it is not desirable to apply mixtures containing lime. They seem fully as effectual as the ammonia solutions and are much cheaper.

Potassium Sulphide.

Potassium Sulphide (liver of sulphur)	3 ounces
Water	10 gallons

This solution is valuable for the gooseberry and other powdery mildews, for which it seems even more effectual than Bordeaux mixture, although its effects are less lasting. It does not discolor the fruit and is quite harmless.

Kerosene Emulsion.

This is a well known remedy for use upon soft-bodied or scale insects that suck the sap. It is made from kerosene, water and soap, either hard or soft, or whale oil.

To one quart of water add one pint of soft or two ounces of hard soap and heat until the soap is dissolved. Add one pint of kerosene and agitate freely for from three to five minutes, or until it forms a cream-like emulsion, from which the oil does not separate upon standing. This is a stock solution and can be kept for any length of time. Before using, it should be diluted according to the condition of the trees and kinds of insects. For scale insects it is desirable to spray while the trees are dormant, after diluting this stock solution so that there will be one part of kerosene to three of water, but if it is applied for the same class of insects while the trees are in leaf, the amount of water should be at least seven or eight times as great as of the kerosene in the stock solution. At this strength it will be fatal to all soft-bodied insects and to many of the scales, while for many of the insects with soft bodies it will be found sufficiently powerful if fifteen parts of water are used to one of the kerosene.

When making the emulsion with whale oil soap, the amount of the soap will vary with the amount of water it contains. If in a semi-liquid condition, one pint will answer for a pint of the oil, while four ounces will be sufficient if it is in a solid form.

In making the emulsion care should be taken to keep the kerosene away from fire, and a force pump should be used rather than to rely upon a spoon or paddle.

Kerosene and Water Mixture.

Fully as good results have been secured when the kerosene has been formed into a mechanical mixture with the water, as when it is emulsified. Within the last three or four years pumps for forming this mixture have been made by The Deming Co., Salem, O., and The Goulds Co., Seneca Falls, N. Y. They can be regulated to supply any proportion of oil that is desired, and do good work. The amount of oil is practically the same as when an emulsion is made, i. e., one part of oil to three of water for scale insects when the trees are dormant, seven parts of water to one of oil for the same insects when the trees are growing, and fifteen parts of water to one of oil for most of the soft-bodied, sucking insects. When applied in this way, the cost of the materials and labor of preparing them is much reduced, and, in addition to securing as good if not better results, it has been found that the danger of injuring tender foliage is lessened.

Pure kerosene and crude petroleum are also recommended for the destruction of scale insects; but as both of them, and the former particularly, require great care in their application, it is better to rely upon the mechanical mixture with water. Kerosene should not be used upon peach trees.

Paris Green.

Paris green	1 pound
Water	100-200 gallons

For the destruction of insects that eat the foliage or fruit, Paris Green is a valuable remedy. It can be used in water in the above proportions, the stronger mixture being used for potatoes, while for fruits it is seldom advisable to use more than one pound in 200 gallons of water, unless in connection with lime water or Bordeaux mixture. It is always advisable to first form a paste with a small amount of water when preparing it for spraying. For low plants Paris green may be used in a powder form either alone or with one hundred times its weight of plaster. London purple is sometimes used in place of Paris green, but it is more apt to injure the foliage. Green arsenoid and arsenate of lead are valuable substitutes for Paris green.

White Arsenic.

As Paris green is quite expensive and is sometimes adulterated, white arsenic is frequently used in its place. Its cost is about one-third that of Paris green, and, as it is nearly twice as effective, the expense is only one-sixth as much as when Paris Green is used. To prepare arsenic for use the following treatment is necessary: In two gallons of water place two pounds of freshly slaked lime and one pound of arsenic; after boiling thirty to forty minutes the arsenic will have dissolved and united with the lime, so as to form an insoluble compound. When desired for use the arsenic should be diluted, and one pound prepared as above will suffice for two to three hundred gallons when used upon fruit trees, or one hundred fifty gallons for spraying potatoes. That there may be no injury to the foliage, it is desirable to use the arsenic thus prepared either with Bordeaux mixture or lime water. When lime water is used, one pound of lime will be sufficient for twenty gallons of water. Although the spraying calendar does not refer to arsenic, it can be substituted for Paris green, if desired.

Lime, Sulphur and Salt Mixture.

Lime, (unslaked)	25 pounds
Flowers of Sulphur.....	15 pounds
Salt	8 pounds
Water	50 gallons

The best results are secured if this mixture is cooked from 1½ to 2 hours. This can be done in a kettle but it will be much easier if steam can be secured. For small quantities place ten or fifteen gallons of water in an iron kettle holding at least twice that quantity; when it is hot add the lime and then put in the sulphur. This should either be sifted in slowly or made into a thin paste and poured in, stirring the mixture at the same time. If likely to boil over add more water. The stirring should be kept up until the lime is all slaked and the sulphur has been added, then boil for at least one hour and then add the salt, and continue the boiling for fifteen minutes. This mixture should only be used while the trees are dormant.

Large amounts should be prepared in the same way but steam should be used for the cooking if possible.

If the spraying has to be done after the buds start, the salt should be omitted and four pounds of sulphate of copper should be used in its place.

The labor of preparing the mixture can be lessened, and fairly good results secured without cooking the sulphur and lime. The sulphur and lime should be prepared as directed above but omit the cooking and add four pounds of caustic soda instead of the eight pounds of salt. Stir the mixture briskly while adding the sulphur and the soda.

When ready for use dilute to fifty gallons with warm water.

Hellebore.

Fresh White Hellebore	1 ounce
Water	5 gallons

For insects that chew, and especially for the currant and cabbage worms.

Pyrethrum or Buhach.

Pure Fresh Pyrethrum	1 ounce
Water	5 gallons

Valuable against both chewing and sucking insects, especially upon maturing fruits or vegetables, and upon flowering plants. It can also be applied in a powder form with a bellows.

Cautions.

The copper solutions should be made in wood, glass or earthen vessels, and should not be prepared in iron or tin.

Care should be taken against spraying plants of any kind with lime or poisonous mixtures within four or five weeks of the time they are to be used as food.

Study carefully the nature of the insect or disease and select the remedy that is most likely to destroy it without injuring the plants.

Do not spray while the trees are in blossom, as the bees will be destroyed: they are necessary to fertilize the flowers.

Pumps for the application of insecticides and fungicides should be sufficiently powerful to cover the trees or plants with a fine mist, and where copper compounds are to be used, the working parts should be of brass, and if all portions that are to come in contact with the spraying mixture are of brass, the durability of the pump will be greatly increased.

L. R. TAFT,
Horticulturist.

C. D. Smith,
Director.

**MICHIGAN
STATE AGRICULTURAL SOCIETY.**

MICHIGAN STATE AGRICULTURAL SOCIETY.

REPORT OF THE TRANSACTIONS OF THE SOCIETY FOR THE YEAR 1902 AND OF THE WINTER MEETING OF THE EXECUTIVE COMMITTEE JANUARY, 1903.

OFFICERS FOR 1902.

President—M. P. ANDERSON, Midland.

Vice President—STEPHEN BALDWIN, Detroit.

Treasurer—C. W. YOUNG, Paw Paw.

Secretary—I. H. BUTTERFIELD, Agricultural College.

EXECUTIVE COMMITTEE.

Term ending January, 1903.

Eugene Fifield.....	Bay City, Bay County.
L. W. Barnes.....	Byron, Shiawassee County.
W. P. Custard.....	Mendon, St. Joseph County.
William Ball.....	Hamburg, Livingston County.
W. E. Boyden.....	West Bay City, Bay County.
Eugene W. Jones.....	Grand Rapids, Kent County.
J. E. Rice.....	Grand Rapids, Kent County.
C. A. Waldron.....	Tecumseh, Lenawee County.
John McKay.....	Romeo, Macomb County.
John A. Hoffman.....	Kalamazoo, Kalamazoo County.

Term ending January, 1904.

E. W. Hardy.....	Howell, Livingston County.
Frank Maynard.....	Jackson, Jackson County.
H. R. Dewey.....	Grand Blanc, Genesee County.
H. H. Hinds.....	Stanton, Montcalm County.
F. E. Skeels.....	Harriette, Wexford County.
Eph. Howland.....	Pontiac, Oakland County.
W. W. Collier.....	Detroit, Wayne County.
Byron E. Hall.....	Port Huron, St. Clair County.
John Marshall.....	Cass City, Tuscola County.
Geo. H. German.....	Franklin, Oakland County.

EX-PRESIDENTS.

Members Ex-Officio.

A. O. Hyde.....	Marshall, Calhoun County.
T. W. Palmer.....	Detroit, Wayne County.

STANDING COMMITTEES AND EXECUTIVE SUPERINTENDENTS.

BUSINESS.

Eugene Fifield, W. E. Boyden, and Secretary.

TRANSPORTATION.

Eph. Howland, H. H. Hinds, W. W. Collier.

PROGRAM.

H. R. Dewey, J. E. Rice, and Secretary.

PRINTING AND ADVERTISING.

I. H. Butterfield, J. A. Hoffman, W. P. Custard.

RECEPTION.

Stephen Baldwin, W. W. Collier, John Marshall.

PREMIUM LIST.

W. E. Boyden, E. W. Hardy, L. W. Barnes, W. W. Collier,
W. P. Custard, Frank Maynard, C. A. Waldron.

RULES.

Eugene Fifield, H. H. Hinds, Geo. H. German.

FINANCE.

E. W. Jones, John McKay, B. E. Hall.

GENERAL SUPERINTENDENT.

Eugene Fifield.

CHIEF MARSHAL.

H. H. Hinds.

EXECUTIVE SUPERINTENDENTS.

<p>Cattle—H. R. Dewey. Horses—Speed—Eugene Fifield. Horses, Roadsters, Draft and Pony Classes—H. H. Hinds. Sheep—William Ball. Swine—L. W. Barnes. Poultry—C. A. Waldron. Dairy, Bees and Honey—John Marshall. Farm and Garden Products—John McKay. Vehicles—J. E. Rice. Agricultural Implements and Machinery—John A. Hoffman. Superintendent Main Building—F. E. Skeels.</p>	<p>Manufactured Goods—F. E. Skeels. Art—Byron E. Hall. Needle Work and Children's Work—Mrs. F. E. Skeels, Harriette. School Exhibits—Frank Maynard. Horticulture—Geo. H. German. Gates—W. P. Custard. Police—E. W. Hardy. Forage—Geo. H. German. Concessions and Privileges—F. E. Skeels. Miscellaneous Exhibits—John McKay. Transportation—Eph. Howland, Asst. Supt. Horticulture, M. L. Dean.</p>
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PROCEEDINGS OF THE EXECUTIVE COMMITTEE.

The executive committee met at the Hotel Hodges, Pontiac, Michigan, on Monday evening, Sept. 22, 8 o'clock p. m.

Present—Anderson, Young, Fifield, Barnes, Custard, Boyden, Rice, Waldron, Hoffman, Dewey, Hinds, Hall, McKay, Howland, Marshall, and the Secretary.

On motion, the caucus of the society was fixed at 4 o'clock p. m., Tuesday, Sept. 23, 1902, at the office of the President on the fair grounds.

The death of Hon. William Ball was mentioned by the President. On motion, Erwin N. Ball was elected to fill the vacancy created by the death of Mr. Ball.

On motion of Mr. Hoffman, the President was requested to name a committee to prepare resolutions concerning the death of the several members of this executive committee, who have died during the year, and that the resolutions thus prepared be a part of the record of the minutes of this society.

The President appointed Mr. Hoffman, Mr. Hinds and the Secretary, such committee.

The resolutions prepared by the committee are as follows:

WHEREAS, During the year just passed the following members, and ex-members of the executive committee of this society have been taken from us by death: Hon. William L. Webber, Hon. William Chamberlain, John Lessiter, Major Dexter Horton, Hon. George W. Phillips, and Hon. William Ball.

Resolved, That we greatly deplore the loss of these men, not only as associates in the labors connected with the work of this society, but as citizens of the commonwealth.

The labors and sacrifices of these men, each of whom had spent a lifetime in this State, engaged always in an effort to build up the institutions of the State, which make for the happiness and well-being of its citizens are worthy of our highest praise.

As associates, in carrying forward the interests of this society, we shall always hold their labors, as being of great value, and worthy of emulation, and the memory of their friendship will always be with us.

Your committee recommends, that a short sketch of each of these men be published in the proceedings of this society, together with portraits if they may be allowed.

JOHN A. HOFFMAN,
I. H. BUTTERFIELD,
H. H. HINDS,

Committee.

It was resolved that a caucus of the society for the nomination of officers be held at the office of the President on the fair grounds at 4 o'clock p. m. of Tuesday, Sept. 23.

It was resolved that the rule regarding the registration of standard bred horses, be construed as follows: "All animals in this class must be standard bred, and must be registered, or eligible to registry, and

such eligibility must be shown by certificate of registry of sire and dam," when required by the superintendent.

Adjourned.

The executive committee met Tuesday evening, Sept. 23, 1902, at 7:30 p. m., at the Hodges House, Pontiac, Michigan.

All members present.

Judges of election were appointed as follows: J. E. Barringer of Macomb county, A. A. Wood of Washtenaw county, Wm. Gaffney of Bay county.

The badge booth on the fair ground was designated as the place for holding the election.

Adjourned.

Thursday evening, September 25, 1902.

Committee met at call of the President.

Present—Anderson, Young, Fifield, Barnes, Custard, Ball, Boyden, Rice, Waldron, McKay, Hoffman, Maynard, Dewey, Hinds, Howland, Hall, Marshall, secretary.

It was moved that only children under fourteen years of age shall be admitted on school tickets on Friday. Carried.

It was resolved to hold the fair open on Saturday, and that the railroads be asked to grant extension of time on return tickets.

Mr. Geo. W. Vaux, assistant passenger agent of the Grand Trunk railroad announced that the return limit of tickets would be extended to Monday, Sept. 29th, and that trains would be continued on Saturday to and from the grounds.

On motion, a rising vote of thanks was tendered the Grand Trunk railroad for the efforts made in arranging for the transportation of visitors to and from the fair of 1902.

Adjourned.

The executive committee met, Friday evening, Sept. 26th, at Hodges House, Pontiac, Michigan.

Present—Anderson, Young, Fifield, Custard, Ball, Boyden, Rice, Waldron, McKay, Hoffman, Hardy, Dewey, Marshall, Hall, secretary.

It was resolved that complimentary tickets do not admit to grounds, and grand stand on Saturday, that press tickets admit on Saturday, but be taken up at the gates, that horsemen's tickets be honored on Saturday by holders being identified.

Admission to grand stand Saturday left at 25 cents.

Adjourned.

CAUCUS.

The caucus of the society was held at the office of the President at four o'clock p. m., Tuesday, Sept. 23.

F. E. Skeels was called to the chair and I. H. Butterfield elected secretary.

On motion of H. C. Guillott the rules were suspended and the secretary instructed to cast the ballot of the caucus for E. Howland as nominee for president. Stephen Baldwin was nominated for vice-president, C. W. Young for treasurer, I. H. Butterfield for secretary.

For members of executive committee for two years: Eugene Fifield, L. W. Barnes, W. P. Custard, Erwin Ball, W. E. Boyden, M. L. Dean, J. E. Rice, C. A. Waldron, John McKay, John A. Hoffman.

The following amendment to the constitution was offered, that the words in section two "Elected prior to 1890" be stricken out, the result to be that all ex-presidents will become members ex-officio of the executive committee.

The amendment proposed was accepted and a vote ordered thereon at the election on Thursday, Sept. 25.

Adjourned.

ELECTION.

The annual election was held on the fair grounds on Thursday, Sept. 25th. The whole number of ballots cast was thirty-one.

The following persons received each thirty-one votes for the respective offices named—and were declared elected to the respective offices, and the amendment to the constitution carried.

President—Ephraim Howland, Pontiac.

Vice-President—Stephen Baldwin, Detroit.

Treasurer—C. W. Young, Paw Paw.

Secretary—I. H. Butterfield, Agricultural College.

EXECUTIVE COMMITTEE.

Eugene Fifield—Bay City, Bay County.

L. W. Barnes—Byron, Shiawassee County.

W. P. Custard—Mendon, St. Joseph County.

Erwin Ball—Hamburg, Livingston County.

W. E. Boyden, West Bay City, Bay County.

M. L. Dean—Agricultural College, Ingham County.

J. E. Rice—Grand Rapids, Kent County.

C. A. Waldron—Tecumseh, Lenawee County.

John McKay—Romeo, Macomb County.

John Hoffman—Kalamazoo, Kalamazoo County.

THE FAIR OF 1902.

The annual fair for 1902 was held on the grounds of the Oakland County Agricultural Society at Pontiac, September 22-26 inclusive.

The exhibit was large in all departments, that in sheep being the largest at any fair yet held. The weather was however, execrable, heavy rain falling continuously from Tuesday p. m., until Friday morning. This reduced the attendance to the minimum. The fair was carried over to Saturday, and Friday and Saturday being pleasant during the day, the attendance on those days was good. The total paid admissions were a little more than 32,000 as against 59,000 in 1901.

The financial result is shown in the reports to be found in the proceedings at the winter meeting.

Had the weather of the week of the fair been fine there is every reason to believe that the attendance would have been larger than in 1901.

WINTER MEETING OF THE EXECUTIVE COMMITTEE.**OFFICERS FOR 1903.****President—E. HOWLAND, Pontiac.****Vice-President—STEPHEN BALDWIN, Detroit.****Treasurer—C. W. YOUNG, Paw Paw.****Secretary—I. H. BUTTERFIELD, Pontiac.****EXECUTIVE COMMITTEE.****Term Ending January, 1904.**

E. W. Hardy.....	Howell, Livingston County
Frank Maynard	Jackson, Jackson County.
H. R. Dewey.....	Grand Blanc, Genesee County.
H. H. Hinds.....	Stanton, Montcalm County.
F. E. Skeels.....	Harriette, Wexford County.
F. G. Jacobs.....	Pontiac, Oakland County.
W. W. Collier.....	Detroit, Wayne County.
Byron E. Hall.....	Port Huron, St. Clair County.
John Marshall	Cass City, Tuscola County.
Geo. H. German.....	Franklin, Oakland County.

Term Ending January, 1905.

Eugene Fifield	Bay City, Bay County.
L. W. Barnes.....	Byron, Shiawassee County.
W. P. Custard.....	Mendon, St. Joseph County.
E. N. Ball.....	Hamburg, Livingston County.
W. E. Boyden.....	West Bay City, Bay County.
M. L. Dean.....	Agricultural College, Ingham County.
J. E. Rice.....	Grand Rapids, Kent County.
C. A. Waldron.....	Tecumseh, Lenawee County.
John McKay	Romeo, Macomb County.
John A. Hoffman.....	Kalamazoo, Kalamazoo County.

EX-PRESIDENTS.**Members Ex-Officio.**

T. W. Palmer.....	Detroit, Wayne County.
M. P. Anderson.....	Midland, Midland County.
John T. Rich.....	Detroit, Wayne County.

PROCEEDINGS OF THE WINTER MEETING.

The winter meeting was called for Monday, January 12th, at 8 o'clock p. m.

A quorum not being present, a meeting was called by the President for Wednesday, January 28th, at the Hodges House, Pontiac.

At this meeting there were present—Messrs. Fifield, Barnes, Custard, Ball, Boyden, Rice, Waldron, McKay, Hoffman, Maynard, Dewey, Hinds, Skeels, Marshall, German, president, treasurer and secretary.

Minutes of that meeting read and approved.

Mr. Hinds asked that the secretary be appointed to prepare resolutions relative to the memory of Ex-president Phillips, deceased. Agreed to. The President read his address as follows:

ADDRESS OF PRESIDENT M. P. ANDERSON.

Gentlemen of the Executive Committee:

Retiring at this time from the office and duties of president of this society, I will make my address as brief as possible and leave the chair for my able successor.

Since our last annual meeting death has again visited our ranks and taken from us two of our ex-presidents, Hon. Geo. W. Phillips and Hon. Wm. Ball; the former owing to long continued ill-health was unable to serve upon the committee although he continued to be a member until his death. The latter was my immediate predecessor in office, one whom I had the pleasure of serving with for over 20 years. No one will be more missed than he, always deeply in earnest, giving his best thoughts and actions to promote the advancement of the society. I trust suitable action will be taken by this body.

When I first became a member of your committee 21 years ago, there was a net balance in the treasury of over \$28 000. I was in hopes to be able to report to you at this meeting a balance of not less than \$30,000. I am quite confident, and I believe you all were, that it might have been done, had we not been caught in a week of copious rains. I feel it a cause of congratulation to the members to be able to say we still have a comfortable balance.

I herewith give you a statement of the receipts and disbursements for the year 1902:

RECEIPTS.

Balance on hand last statement	\$18,912 49
Receipts from all sources	24,620 37
Total	\$43,532 86

DISBURSEMENTS.

Total business orders, including speed.....	\$18,661 83
Total premium orders paid	11,340 81
Total balance on hand	13,530 22
Total	<hr/> \$43,532 86

The expense account was reduced by discharging help which had been engaged with the expectation of a repetition of the 1901 attendance. Eatables were well supplied and had the weather permitted the people to have attended, I believe they would have been well cared for.

I wish to make special mention of the courtesies extended by all the steam railroads, especially of the D. G. H. & M. and the P. O. & N.

EXHIBITS.

The exhibits were very creditable in all departments, exhibitors put up with the inconveniences, sympathizing, instead of criticising the management on account of the continued heavy rains. No complaints came of anyone failing to handle successfully his department.

STATE AID.

I believe this society should present to the present legislature a request for another appropriation for the coming two years.

PERMANENT LOCATION.

The matter of permanent location. I believe should receive careful thought by each member; the condition of streets and walks last year should stimulate action toward getting settled down where permanent and lasting improvements can be made. The different exhibition buildings should be connected with suitable walks, good walks from entrance to main hall and grand stand. Again with a home, the unsightly shanties erected by the dozens for privileges, mars the beauty of the grounds. This matter has been brought up from time to time for years past. It is a difficult question to solve, the sooner it is worked out, I believe, the sooner it will inure to the benefit of the society.

It might be good policy to have two locations, one in the eastern, the other in the Western part of the State, holding biennial exhibitions. In doing this it would make it possible to reach many people who are unable to travel so far to visit the fairs—Michigan is a large state. While the railroads make some reductions in fare still it is too high for many to attend. Reasonable state aid which should be extended would make it possible to have a creditable place to hold exhibitions which would not only be a credit to the State, but an everlasting convenience to the exhibitors and visitors. Money is appropriated to erect buildings in other states representing Michigan with all its great resources. It should certainly aid in having a permanent location or locations at its own home, as many from other states annually visit our State fairs.

IN CONCLUSION.

I tender you gentlemen my sincere thanks for your efficient and cordial support. Inasmuch as by your action you have seen fit to place me upon your executive board for life, I trust my future relations may be of such a character as not to cause regrets. Twenty years of association with many of you, so far as I know have been pleasant and agreeable, and I assure you it gives me much pleasure to be retained by you, that I may be able to continue the pleasure of working with you to help promote the the best interests of this society. I have endeavored to do my duty as best I could. The loyal support and willingness upon your parts to take up your duties as allotted to each was a source of pleasure to me.

I now lay down the gavel and wish my successor and the society abundant prosperity.

M. P. ANDERSON.

A protest received from Mr. J. W. Beddow of Birmingham relative to the award on cheese was not sustained.

Also a protest from E. C. Kern of Detroit, relative to allowing horse of D. H. Harris to compete not sustained.

Mr. E. Howland presented his resignation as member of the executive committee, having been elected president, the resignation was accepted and F. G. Jacobs was elected to fill the vacancy.

REPORTS OF EXECUTIVE SUPERINTENDENTS.

The executive superintendents report as follows:

CATTLE.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—I am pleased to report that the exhibit of cattle at the fifty-third annual fair held at Pontiac, September 22 to 26, 1902, was one of the largest and most creditable known in the history of the society.

The courage, courtesy and patience of the exhibitors during the week of almost constant rain was most commendable and showed a training and restraint seldom found, except among breeders of stock.

On account of the great number of entries and close quarters, herds were broken and scattered, causing a great amount of extra labor which was endured without complaint.

The first day's judging was done in the open air, until all were drenched with mud and rain, after which it was thought best to attempt the work in the stables where it was finally completed to the credit of all. Had there been a premium offered on patience and courage, I am sure the cattle breeders would have drawn a barrel of money.

The premium offered to Michigan breeders, made possible by the ap-

appropriation from the State was a great incentive to bring out the fine Michigan bred cattle and should be continued by a like appropriation for the years 1903 and 1904.

The total number of entries was 653.

Respectfully submitted,

H. R. DEWEY,
Superintendent.

HORSE DEPARTMENT.

To the Executive Committee of the State Agricultural Society:

Gentlemen—The details as to classification, prizes offered, amounts awarded, etc., in the horse department are carried in the secretary's annual report. The entries in the horse department at the Michigan State Fair of 1902, were not what might have been expected in view of the location in which the fair was held.

The eastern part of the State is extensively interested in fine horses of all the different breeds, and would promote its interests by larger exhibits at the annual State fair. The quality of the stock on exhibition was generally of a high standard.

There is no other department of a State fair but what can better exhibit its rings and make its awards in a week, which probably nearly resembled an average week during Noah's flood, than the horse department.

It is a physical impossibility in the narrow alleys of the horse barns to exhibit large rings of fine horses and make awards satisfactory to the judge or the spectators. Like all other departments showing under roof at our late fair, the alleys of the horse department were constantly thronged, with men, women and children, a crowd that was good natured to a degree, but practically a mob when it came to the exhibition of lively stepping horses in the same alley.

The department was fortunate in being served by judges of long experience, and who rank among the best in the country. It is a surprise to the superintendent that the work of the judges was so well performed under the circumstances. Several large entries were not present at all, owing undoubtedly, to the unpropitious condition of the weather during the entire fair.

The change of the date of the annual fair from the latter part to the fore part of September, thereby placing the Michigan State Fair in one of the general fair circuits, will materially help the exhibition of fine horses owned by exhibitors making the grand circuit.

H. H. HINDS,
Superintendent.

SPEED DEPARTMENT.

To the President and Members of the Michigan State Agricultural Society:

As superintendent of the speed department, I beg leave to submit the following report:

The liberal amount of money that was placed in my hands to offer for speed premiums enabled us to secure good entries.

All classes in the speed department filled, except one, and that was the free for all trot.

In the ten races we had 104 entries, which would have taken place had it not been for the rain of the entire week, with an average of more than ten horses for each race.

Michigan as a natural consequence was well represented in every class. We had horses from Ohio, Indiana, Virginia, and Canada, which helped to swell the list, and I believe the owners of the different stables sent the pick of their stables as they knew they would have to step to win, and that it would be necessary to race from wire to wire to get any of the money, as a result of the weather only one race the 2:35 trot was finished.

Then the 2:15 pace was called and one heat was finished and was then adjourned from day to day as the rules require on account of the rain and condition of the track and continued until the race was declared off, and money paid as the horses finished in the one heat.

The balance of the races were declared off, and the entrance money refunded and a sorry ending to what promised so much. But Michigan was not alone, for fairs and meetings all over the country were seriously handicapped, and many were obliged to close their gates and declared not only their races but their exhibits off.

I think we can congratulate ourselves as managers of the Michigan State Fair that we awarded and paid our premiums in full.

Yours respectfully,

EUGENE FIFIELD,
Superintendent.

The money awarded as follows:

Tuesday, September 23.

Class No. 1, 2:35 Class trotting, Purse, \$500.

To entrance, Great Scott.....	\$50 00	By paid, Great Scott.....	\$250 00
" " Silk Mill Girl.....	50 00	" " Silk Mill Girl.....	125 00
" " Amorel.....	50 00	" " Amorel.....	75 00
" " Good Timber.....	50 00	" " Good Timber.....	50 00
" " Bessie K.....	25 00		
" " Cresco.....	25 00		

To balance.....\$250 00 Time in rain, 2.27½.

Class No. 2, 2:15 Class pacing, Purse, \$500.

To entrance, Jno. H. Walmer....	\$50 00	By paid, Jno. H. Walmer.....	\$250 00
" " Verlin.....	50 00	" " Verlin.....	125 00
" " Hal. Patron.....	50 00	" " Hal. Patron.....	75 00
" " Wayne King.....	50 00	" " Wayne King.....	50 00
" " Dusty Wilkes.....	25 00		

To balance.....\$275 00 Time in mud, 2.16½. First half, 1.06.

POULTRY.

Mr. President and Members of the Executive Committee:

As superintendent of poultry, I beg leave to submit the following report:

In Division E we had 1,230 entries, being the best lot of birds as a whole that we have ever had since I have had the honor of being superintendent. Owing to the large amount of entries, we were short of room this year, although the capacity of the building had been nearly doubled the past season.

There are several changes in the premium list that I would like to suggest to the premium list committee—A few new varieties that are worthy and should be admitted, and I think it would be well to offer a diploma to the best exhibit of incubator and brooder doing actual work on the ground.

C. A. WALDRON,
Superintendent.

FARM AND GARDEN PRODUCTS.

To the President and Executive Committee of the State Agricultural Society:

The entries in Division F at the fair of 1902 were in Class 48. Grains and Seeds, 88 entries. Premiums offered \$150.00. Award, \$72.00.

I would recommend the following changes in Lot 1112. Judges to make two first, and two second awards on as many different varieties each variety to compete with the same variety—one-half bushel of grain; also the same changes in Lot 1113 and Lot 1114.

CLASS 49.—ROOTS AND VEGETABLES.

Entries 207, premiums offered \$109.50. Award, \$93.00.

I would recommend that Lot 1149 be changed as follows: Judges to make two first and two second awards on as many different varieties, each variety to compete with the same variety in other entries. The premiums to be \$3.00 and \$2.00—the same change in Lot 1150.

Collections, entries 6; offered, \$100.00; award, \$100.00; the amount offered for collections, ought to be reduced some.

COUNTY EXHIBITS.

Entries, 6. Premiums offered. \$300.00. Award, \$155.00. I think that it would be well to increase the premiums for county exhibits; also that the whole exhibit be shown in one place, all of which is

Respectfully submitted,

JOHN McKAY,
Superintendent.

DAIRY DEPARTMENT.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As superintendent of Divisions G and H, Classes 52, 53 and 54. I beg to report as follows:

	Entries.	Amount offered.	Awarded.
Creamery Butter	15	\$90 00	\$70 89
Dairy Butter	29	45 00	37 61
Print Butter	15	20 00	17 67
Cheddar Cheese	15	55 00	23 14
Michigan Cheese	18	55 00	22 25
Young America Cheese...	7	23 00	15 50
Fancy America Cheese...	5	12 00	12 00
Diamond Salt, Special....	51	.....	.....
Sugar. Bread, Etc.....	47	53 00	33 00
Totals	202	\$353 00	\$232 06

Dairy implements were well represented by a number of firms from Michigan, and adjoining states. The refrigerator gave good satisfaction.

In Division H, Class 53, bees, honey, and apiarian implements there were no entries from what cause I am unable to state.

All of which is respectfully submitted.

JOHN MARSHALL,
Superintendent.

VEHICLES.

To the President and Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—In Division K, carriage and vehicle department, I beg to report as follows:

Whole number of entries, 35. Every one seemed satisfied and promised to come with us in 1903.

Respectfully,
J. E. RICE,
Superintendent.

FARM IMPLEMENTS AND MACHINERY.

Mr. President and Members of the Executive Committee:

Your superintendent of farm implements and machinery would report 112 exhibitors in the department, consisting of threshers, engines, huskers and shredders, ensilage cutters, bean threshers, feed cutters, feed grinders, stone cutters, road machines, plows, harrows, cultivators, grain drills, corn planters, potato planters and diggers and all kinds of tools for cultivating and harvesting sugar beets, a large display of gasoline engines, in fact, it was the largest display of implements ever on a fair ground in Michigan. They came from the extreme east, west, north, and south.

There was a large display of wind mills and pumps, and wire fence was a great factor in the display. In all we had between eleven and twelve hundred articles on exhibition representing a capital invested of nearly \$80,000,000 as an evidence of the enormous investments required in the manufacture of farm implements and machinery. It will be worth our efforts to make extraordinary inducements to have them exhibited at our fairs.

The present year our ground should be in good condition and water should be on the line of engines and threshers display, so they would not be compelled to haul it in tanks. To my mind it will require a great effort on the part of all officers and the superintendent to induce exhibitors this year. It will require advertising and I believe that money could be well invested to visit large manufacturers and officers of other fairs held in advance of ours to interest them in our behalf. The time to begin is from this day.

In 1902 I asked for premiums of best display on implements in and out of the State. While I think it paid us, I would not ask it for 1903, but recommend that the superintendent be allowed the amount of premiums namely: \$200 to advertise the implement department, if in his judgment it required it. I think it would do the society more good than to pay it out to a few exhibitors.

Respectfully submitted,

JOHN A. HOFFMAN,

Superintendent Farm Implements and Machinery.

MAIN BUILDING—HOWLAND HALL.

Harriette, Mich., January 27, 1903.

Officers and Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As superintendent of the Howland building—I wish to report that each department in the hall was well filled—the fruits and flowers, the dairy, the needle work, school and the art departments will each file reports showing the extensive nature of their exhibits—in the general display the exhibit made by the State Fish Commission was perhaps the most attractive and we should make it a certain feature of each fair, if possible.

The general public seem to enjoy a display of animal life, more than some of the exhibits of manufactured products. A great feature in the main building last year was the very fine exhibits made by the State institutions, as the Michigan Agricultural College, the Flint School for the Deaf, the Adrian Industrial School for Girls, and an extraordinary effort should be made to secure these again as well as the Lansing Industrial School for Boys—the School for the Blind and any other public institution that can make a showing of its work.

Last year in our greed of gain we allowed some privilege people to vend their wares in the aisles of the buildings, and for this act we deserve censure. The receipts from these people were about \$500.00, but if fair weather had favored us these small merchants would have been carried out of the building by the mob—no persons should be allowed to use the

center aisles of the wings for any purpose except, as a point from which to view exhibits.

We need, and must have more room in the main exhibition building, if we would keep our exhibits at a standard that will attract the people; we could not give the State institutions anything like the room they would have filled and we turned from our doors some very fine exhibits from Detroit, Saginaw and other points.

Very many of the people who pay for space from which to sell their goods, make excellent exhibits and show great skill in their workmanship—especially is this true of the burnt leather work, the engraving on glass, and much of the shells and jewelry—if we wish to hold these exhibits and get their money, we must be prepared at our next fair to give them more room. Our fair of last year attracted much attention, and many letters have already been received, asking for space. The space allotted for fruits and flowers is much too small for the offerings.

The wing used by the dairy superintendent is so congested in its exhibits that much of the material has to be shown in the aisle. We need for other exhibits the room used by these departments in the main building, and these departments need double the space they now occupy for the constantly increasing business coming to them, in other words, we need and must have a building for the dairy and horticultural departments of our fair.

It would probably be folly to ask aid from the State, and I fully believe that these buildings could and should be built by people in the immediate vicinity, of the location of our next fair. I would also add here, that we should never again place another exhibit in the Howland building, until the roof is so repaired that it is water-proof. I would therefore recommend that such action be taken as will insure the erection of suitable building or of buildings to accommodate the horticultural and dairy interests of our State fair in time to be available for the fair of 1903, and that the roof of the Howland building be thoroughly repaired, provided that we hold our fair of 1903 in the City of Pontiac.

Respectfully,

F. E. SKEELS,
Superintendent.

ART DEPARTMENT.

To the Officers and Members of the Executive Committee of the Michigan State Fair Association:

Gentlemen—As superintendent of art at the State fair held at Pontiac, Mich., September 22 to 26, 1902, I submit to you my report of Division N, Classes 60 and 61 of premium list for the year 1902:

Division N.—Class 60.—Painting, Sculpture, Etc.

By Professionals or Amateurs.—Premiums offered, Lots 1207 to 1303, \$105.00; awarded, \$75.00. Premiums offered. Lots 1304 and 1305, \$12.00; no award.

Photographs made by exhibitor.—Premiums offered Lots 1306 to 1312, \$28.00; awarded, \$26.00.

Paintings by professionals, artists and art teachers.—Premiums offered Lots 1313 to 1348, \$335.00; awarded, \$116.50.

Division N.—Class 61.

Paintings and drawing by amateur artists.—Premiums offered Lots 1349 to 1371, \$115.00; awarded, \$101.25.

Premiums offered Lots.—Industrial Art.—Premiums offered Lots 1372 to 1388, \$96.00; awarded, \$14.00.

Curiosities.—Premiums offered, \$25.00; awarded, \$25.00. Grand total premiums offered, \$716.00; awarded \$357.75.

Several diplomas were recommended upon non-enumerated articles of merit. Also report that I had several complimentary exhibits from Detroit and other artists which added largely to the display and with very little expense to the society.

Recommendations.

First, That a better description be given on photographs as to size; also work.

Second, That premiums be given for hand painted China in the professional class as well as the amateur class.

Third, That a premium be offered for photograph work on China or porcelain. I would also recommend that the art premium list be printed on separate sheets so as to be placed in the hands of the artists a little early, giving them more time to prepare new work for this department. That a line of instructions be given that the productions of professionals and amateurs will be classed and hung separately, I think this item for the good of the department.

Respectfully submitted,

B. E. HALL,
Superintendent.

Harriette, Mich., January 26, 1903.

To the Officers and Members of the Executive Committee of Michigan State Agricultural Society:

Gentlemen—The exhibit in the needle work department was much larger last year than at any previous fair that I have attended. The work was of a superior quality and sufficient in quantity to fill the entire space allotted.

	Entries.
Class 63—Professional	98
Class 64—Amateur	226
Class 65—Miscellaneous	123
Class 66—Crochet and Knit	59
Class 67—Specials	21
Class 68—Childrens	17
Non-enumerated articles	60
Total	604

Total premiums offered\$345 50
Total awarded\$243 50

From the above items it will be found that the non-enumerated articles form a small exhibit of themselves. I would therefore suggest an entire revision of the needle work department. I have carefully looked over the list of non-enumerated articles entered—kindly furnished me by Secretary Butterfield—also have compared your list with the premium lists of other state fair associations and from these have compiled a new list which I would recommend for the consideration of your premium list committee.

Respectfully,

MRS. F. E. SKEELS.

Superintendent.

REPORT OF THE ASSISTANT SUPERINTENDENT OF THE HORTICULTURAL SOCIETY.

Mr. President and Officers of the Michigan State Agricultural Society:

I beg to submit my second report before your august body, and if brevity has been a prevailing custom I hope that you will pardon me if I step beyond bounds.

At the outset I wish to say Michigan never placed before the patrons of her State fair a better display of fruit than was displayed under the direction of your honorable superintendent of horticulture, George H. German in 1902. Perhaps as large collections have been displayed, but I speak from the standpoint of quality as well as quantity. The floral display was deficient owing to several reasons. There were of apples 1,273 plates; peaches 646; pears, 383; plums, 406; grapes, 215; crab apples, 64; quince, 15; a total of 3,002; three of cranberry; 1 of blackberry, and one of English Walnut.

For list of entries, and amounts awarded in the several classes, see the report of the secretary.

By solicitation I have secured several special premiums to be added to the list for 1903 among which are the following: Fifty fruit trees from Greening Bros. nursery for the best fifty plates of fruits grown on trees purchased from them. The same offer I have from Ilgenfritz Bros. The Central Michigan Nursery, of Kalamazoo, and the West Michigan Nursery of Benton Harbor. I also have an offer of \$100 from the Armour Fertilizer Works for the best display of fruit aided in the growth by the use of their fertilizers. I also have several minor premiums including spray-pumps, ladders, etc., which I hope to complete.

While I would not recommend the asking of more liberal premiums at this time, yet I do believe that the department should be entitled to the use of the money offered, and that some radical changes should be made in its distribution which will greatly help in the betterment of the displays.

The fruit industry brings into the hands of Michigan farmers enormous sums of money and its prominence is bound to be recognized, and the growers encouraged so that the banner of Michigan fruits shall hold its place in the front ranks. I coincide with the idea of encouragement all

along the line, but sometimes we are shifted or sidetracked by sympathy, such, I believe, is the case with the premiums offered for the Upper Peninsula county collections. They should be encouraged, but the quality of their displays has not warranted the premiums offered. Hence, I would recommend the striking out of Lot 1549 and transfer the fruit part of their display to and with the general county displays and put it with their county collections in the Agricultural Hall. It will certainly help to improve their displays.

To Lot 1550 I would recommend the adding of Huron county to the list. Lot 1551 is all right. Lot 1552 strike out. But I maintain that the premium of 1449 and 1552 should be held and combined into one grand sweepstake prize of \$100 for first—\$60, for second—\$40, for third—premium, for the largest and best display from any one county, society or individual in Michigan.

New York puts up \$300 for such a prize and \$200 for the second, and her fruit displays are of world-wide reputation. Michigan grows just as good fruit if we can only encourage the growers to display it. Class 70, Lot 1554, strike out and divide the premiums between Lots 1555 and 1556, Class 71.

Michigan State fair offers no larger premiums on single plates, than some county fairs. Illinois and Ohio give \$2.00 and \$1.00 on single plates. New York and Indiana, \$1.50 and \$1.00. Toronto, \$2.50, \$2.00, and a third prize of \$1.50; Iowa, \$1.00 and 50 cents for second. Michigan offers 75 cents for the first prize and 50 cents for the second. Gentlemen, I declare this to be an outrage.

Another important industry in our line seems to have been overlooked. and I suggest at least the offering of a diploma for the largest and best display of commercial canned goods put up in Michigan; yet I consider it of magnitude enough to warrant a more substantial premium. The pure fruit juice industry is crowding for a place among our leading commercial enterprises.

There are some changes in the lists of single plates of minor importance as follows:

To the list of apples, I would add: Ohio, Nonpareil, Lawver, York, Imperial, Spitzenburg (Esopus), Willow Twig.

To the pears—Tyson, Lincoln.

To the peaches—Globe, Wonderful.

To the plums—German Prune.

To the grapes—Jefferson.

M. L. DEAN,
Assistant Superintendent.

SCHOOL WORK.

Jackson, Mich., January 27, 1903.

To the President and Executive Committee of the Michigan State Agricultural Society:

As superintendent of Division "S," I beg leave to submit the following report; the whole number of entries in Division "S" was 79.

The exhibit was one of the finest we have ever had both in merit and in size. In view of the crowded condition owing to the size of the exhibit would recommend that some radical changes be made in the premium list.

which would greatly facilitate the work in the secretary's office and in adjudging and giving awards, and would further recommend that the classes and sub-classes remain as at present, the entry of each school competing to be registered with the secretary of the association in the class in which they desire to compete, merit with percentage ranging from 100 per cent down to 70 per cent.

All of which is most respectfully submitted.

FRANK MAYNARD,
Superintendent of Division "S."

GATES.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—I respectfully report that I employed 16 men; 14 gate-keepers and two grand stand ticket takers.

I paid the gate-keepers three dollars per day and railroad fare, excursion rates, and grandstand men, one dollar and twenty-five cents each, half days, making a total of \$286.98. This pay roll is somewhat larger than in 1901. We had one more gate this year and one more fair day as the fair was held over until Saturday night—that makes the difference. All of which I respectfully submit.

W. P. CUSTARD,
Superintendent of Gates.

REPORT OF THE SUPERINTENDENT OF POLICE.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—I submit the following report for the year 1902. Good order was maintained throughout the rain and unpleasant week of the fair. While the expense was much more than usual, there is reason for it. With the advice of members of this committee, it was thought best to increase our force, already full, adding 12 extra men; that, with the one day extra fair has made the expense of the department unusually large. Total of pay roll, \$833.44.

E. W. HARDY,
Superintendent of Police.

RENTS AND PRIVILEGES.

To the Officers and Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—Owing to the weather which prevailed during almost the entire fair of 1902, the receipts from the privilege department were somewhat lower than in some former years. These parties who secured space within the main building or in other sheltered localities seemed to do a profitable business.

The shows, merry-go-round, and dining-hall concessions were almost

total failures and the per cent derived from their sales did not add much to our treasury—several stand contracts were cancelled. The total receipts from all sources was \$2,548.01.

Respectfully submitted,

F. E. SKEELS,
Superintendent.

TRANSPORTATION.

To the Officers and Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As superintendent of transportation, I would report as follows: The facilities for rendering transportation services were undoubtedly amply provided for at the last fair, but unfortunately the weather prevented their being put to a test; from the fact, gentlemen, that our next fair is not yet located, it is not appropriate to offer any recommendations.

Signed, E. HOWLAND,
Superintendent.

The reports were received and referred to the committees on premium list and on rules.

REPORT OF THE SECRETARY.

To the Executive Committee:

Gentlemen—As will be seen by the statistics to be submitted, the entry list was very large at the last fair. Nearly every department was full to overflowing, making a large amount of work in the office, but the books were ready for the superintendents on time. The keeping open of entry books on fruit until Tuesday a. m., makes a delay in preparing the books in that department. If it is necessary to hold the entries till the first of the fair week, it would seem that they might close Monday night.

Stock entries might close even earlier than 10 days before the fair. As we now construe the rules to apply to entries mailed on the second Saturday preceding the fair, some are not received till Monday p. m. of the week before the fair, and while nominally called ten days before the fair, it is in reality but five days.

In the sheep and swine classes I believe a fee of 10 cents per head should be charged for entry fee, and in the poultry class many exhibitors favor a moderate fee per fowl.

The rules need some revision, namely in wording more explicitly so that there can be no difficulty in understanding the meaning.

I suggested to the committee on rules last year the advisability of using two coupons on the membership certificate one good on Monday and the other good on Friday.

This would be for the benefit of the small exhibitor. Many of the exhibitors in needle work art, some in fruit, poultry and vegetables can not put their articles on exhibition until Monday morning, hence one coupon is used. On Friday it is quite important that they be on hand to take care of their articles before the gates are thrown open after 4 o'clock.

While a Friday coupon would give admission on Friday to the fair it would save much dissatisfaction by these exhibitors and is a concession to my mind no more than just, since this class of exhibitors contribute most of the show in needle work and art and many of them can not receive any premiums. In the case of any exhibitor to whom button passes are given the rule should provide that the superintendent take up both coupons, when issuing the button orders.

I think that some charge should be made for space in the main building for advertising exhibits. The space is costly and I think the exhibitors would be willing to pay a reasonable sum for space.

An additional building is needed for the dairy department unless it can be accommodated in the vegetable hall.

Moneys Received 1902.

From American Short Horn Breeders' Association	\$483 00
From Memberships sold	483 00
From stall rents collected	374 70
Total	<u>\$1,340 70</u>

A Statement of the entries in each class and division with the amounts offered and the amounts awarded is herewith given. The report was received and referred to the finance committee.

**LIST OF ENTRIES IN THE SEVERAL CLASSES WITH AMOUNTS
OF PREMIUMS OFFERED AND AMOUNTS AWARDED AT
THE FAIR OF 1902.**

Cattle.

Class.	Single.	Herds.	Total entries.	Amount offered.	Amount awarded.
1 Shorthorns, open to all.....	91	31	122	\$500 00	\$473 00
1A Shorthorns, open to Michigan.....	89	23	112	500 00	493 00
2 Devons, open to all.....	36	5	41	285 00	268 00
2A Devons, open to Michigan.....	..	..	..	222 00	.....
3 Herefords, open to all.....	37	4	41	285 00	222 00
3A Herefords, open to Michigan.....	27	2	29	222 00	139 00
4 Galloway, open to all.....	33	6	39	285 00	256 00
4A Galloway, open to Michigan.....	29	3	32	222 00	222 00
5 Aberdeen Angus, open to all.....	16	1	17	285 00	164 00
5A Aberdeen Angus, open to Michigan....	14	2	16	222 00	168 00
6 Jersey, open to all.....	46	5	51	285 00	258 00
6A Jersey, open to Michigan.....	30	3	33	222 00	186 00
7 Guernsey, open to Michigan.....	..	..	..	222 00	.....
8 Holstein, open to all.....	30	4	34	285 00	228 00
8A Holstein, open to Michigan.....	23	3	26	222 00	190 00
9 Red Polled, open to all.....	17	3	20	285 00	207 00
9A Red Polled, open to Michigan.....	17	1	18	222 00	139 00
10 Fat Cattle	15	7	22	107 00	96 00
Totals	550	103	653	\$4,878 00	\$3,709 00

\$483.00 of the amount paid on Shorthorns was paid by the American Short-horn Breeders' Association.

Horses.

11 Standard Bred	53	\$267 00	\$234 00
12 Roadsters	22	138 00	61 00
13 Carriage	28	163 00	92 00
14 Saddle	21	86 00	36 00
15 All Work	40	236 00	153 00
16 Cleveland Bay, open to all.....	..	235 00	.....
16A Cleveland Bay, open to Michigan.....	1	171 00	11 00
17 French Coach, open to all.....	2	235 00	28 00
17A American or French Coach, open to Michigan....	3	171 00	14 00
18 Hackney, open to all.....	7	235 00	51 00
18A Hackney, open to Michigan.....	6	171 00	50 00
19 Percheron, open to all.....	3	235 00	42 00
19A Percheron, open to Michigan.....	6	171 00	43 00
20 Clydesdale or Shire, open to all.....	5	235 00	14 00
20A Clydesdale or Shire, open to Michigan.....	5	171 00	32 00
21 Grade Draft	17	135 00	82 00
22 Shetland	4	235 00	45 00
23 Fine Coach .....	..	100 00	.....
Totals	223	\$3,340 00	\$988 00

Sheep.

	Single.	Flocks.	Total entries.	Amount offered.	Amount awarded.
24 American Merino, open to all.....	60	5	65	\$168 00	\$168 00
24A American Merino, open to Michigan...	52	6	58	168 00	168 00
25 Rambouillet Merino, open to all.....	66	7	73	126 00	126 00
25A Rambouillet Merino, open to Michigan.	55	6	61	126 00	126 00
26 Delaine Merino, open to all.....	48	5	53	126 00	119 00
26A Delaine Merino, open to Michigan.....	36	4	40	126 00	126 00
27 Franco-American, open to Michigan...	19	3	22	126 00	61 00
28 Lincoln, open to all.....	28	4	32	114 00	55 00
28A Lincoln, open to Michigan.....	39	5	44	114 00	55 00
29 Leicester, open to all.....	17	3	20	114 00	75 00
29A Leicester, open to Michigan.....	18	3	21	114 00	80 00
30 Cotswold, open to all.....	31	9	40	114 00	55 00
30A Cotswold, open to Michigan.....	19	4	23	114 00	67 00
31 Shropshire, open to all.....	119	15	134	126 00	126 00
31A Shropshire, open to Michigan.....	88	12	100	126 00	126 00
32 Hampshire, open to all.....	41	9	50	114 00	114 00
32A Hampshire, open to Michigan.....	30	5	35	114 00	87 00
33 Oxford, open to all.....	80	14	94	114 00	109 00
33A Oxford, open to Michigan.....	46	7	53	114 00	109 00
34 Southdown, open to all.....	88	15	103	114 00	114 00
34A Southdown, open to Michigan.....	31	5	36	114 00	95 00
35 Horned-Dorset, open to all.....	18	3	21	114 00	62 00
35A Horned-Dorset, open to Michigan.....	22	3	25	114 00	51 00
36 Fat Sheep	21	1	21	54 00	17 00
37 Angora Goats	14	1	15	114 00	55 00
Totals	1087	153	1240	\$2,882 00	\$2,346 00

Specials offered by Record Associations:

Hampshire Association	\$25 00	\$25 00
Oxford Association	30 00	30 00

Swine.

	Herds.				
38 Berkshire, open to all.....	102	23	125	\$132 00	\$132 00
38A Berkshire, open to Michigan.....	59	14	73	132 00	132 00
39 Poland-China, open to all.....	17	5	22	132 00	100 00
39A Poland-China, open to Michigan.....	14	4	18	132 00	69 00
40 Essex, open to all.....	35	11	46	132 00	111 00
40A Essex, open to Michigan.....	14	1	15	132 00	74 00
41 Suffolk or Small York, open to all.....	32	8	40	132 00	101 00
41A Suffolk, or Small York, open to Michigan.	21	5	26	132 00	101 00
42 Chester White, open to all.....	36	11	47	132 00	118 00
42A Chester White, open to Michigan.....	10	3	13	132 00	69 00
43 Large Yorkshire, open to all.....	4	..	4	132 00	12 00
43A Large Yorkshire, open to Michigan.....	16	..	16	132 00	34 00
44 Victoria, open to all.....	27	7	34	132 00	73 00
44A Victoria, open to Michigan.....	64	23	87	132 00	132 00
45 Duroc Jersey, open to all.....	5	..	5	132 00	6 00
45A Duroc Jersey, open to Michigan.....	14	6	20	132 00	44 00
46 Tamworth, open to all.....	..	..	..	132 00	.....
46A Tamworth, open to Michigan.....	..	..	..	132 00	.....
Totals	470	121	591	\$2,376 00	\$1,203 00

Poultry.

47	Asiatic	165	\$48 00	\$47 00
	American	239	66 00	57 50
	Bantam	156	78 00	45 50
	English	12	18 00	9 00
	French	21	18 00	11 00
	Game and Game Bantam	203	102 00	64 50
	Mediterranean	81	60 00	54 00
	Hamburg	66	36 00	25 00
	Polish	57	30 00	23 50
	Miscellaneous	21	24 00	9 00
	Turkey	25	18 00	10 00
	Duck	45	15 00	14 50
	Goose	32	15 00	14 00
	Ornamental	12	4 00	6 00
	Pigeon	5	3 00	3 00
	Non-enumerated	100	....	44 00
	Totals	1240	\$535 00	\$437 00

Farm and Garden Products.

48	Grains and Seeds	88	\$150 50	\$72 00
49	Roots and Vegetables	207	109 50	93 00
50	Collections	6	100 00	100 00
51	County Exhibits	6	300 00	155 00
	Totals	307	\$660 00	\$420 00

Dairy, Domestic, Apiary.

52	Butter and cheese:			
	Creamery Butter	15	\$90 00	\$70 89
	Dairy Butter	29	45 00	37 61
	Dairy Print Butter	15	20 00	17 67
	Cheddar Cheese	15	55 00	23 14
	Michigan Cheese	18	55 00	22 25
	Young America Cheese	7	23 00	15 50
	Fancy Cheese	5	12 00	12 00
	Diamond Salt Specials	51	....	....
53	Sugar, Bread, etc.	47	53 00	33 00
54	Bees, Honey and Apiarian Implements ..		139 00	.....
	Totals	151	\$492 00	\$232 06

Farm Implements.

55	Collection, manufactured in State	3	\$100 00	\$100 00
	Collection, manufactured out of State	3	100 00	100 00
	Totals	6	\$200 00	\$200 00

Manufactures.

56	Wool and materials	4	\$46 00	\$5 00
	Totals	4	\$46 00	\$5 00

Art.

60	Collections, Frames, etc.....	47	\$145 00	\$101 00
	Professional Paintings and Drawings.....	51	330 00	135 50
61	Amateur Paintings and Drawings.....	84	115 00	108 25
62	Industrial Art	8	101 00	14 00
	Curiosities	4	25 00	25 00
	Non-enumerated	18	.....	22 00
	Totals	212	\$716 00	\$405 75

Needlework.

63	Professional	98	\$133 25	\$81 75
64	Amateur	226	100 75	75 75
65	Miscellaneous	123	40 25	33 00
66	Crochet and Knit	59	21 75	14 75
67	Special	21	30 00	Paid
68	Childrens'	17	19 50	8 75
	Non-enumerated	60	.....	29 50
	Totals	604	\$345 50	\$243 50

Fruit.

69	County Exhibits	6	\$400 00	\$210 00
70	Artistic Exhibits	5	41 00	31 00
71	Collections	50	339 00	291 00
72	Single Plates:			
	Apples, Summer	30	17 50	9 50
	Apples, Autumn	67	20 00	17 25
	Apples, Winter	218	47 50	30 25
	Apples, Crab	20	8 75	7 75
		335		
	Pears, Summer	28	8 75	6 50
	Pears, Autumn	90	23 75	21 50
	Pears, Winter	27	10 50	8 50
		145		
	Peaches	116	41 25	39 25
	Plums	96	48 75	44 00
	Grapes	58	20 00	16 50
	Quinces	11	3 75	3 75
	Cranberries	3	3 75	2 25
73	Dried, Canned and Pickled Fruit and Vegetables...	30	90 00	70 00
74	Plants in Pots, professional growers.....	20	183 00	68 50
75	Cut Flowers, professional growers.....	13	105 00	72 00
76	Plants in Pots, amateur growers.....	18	56 75	28 50
77	Cut Flowers, amateur growers.....	26	31 00	26 00
	Non-enumerated	21	.....	2 25
	Total in Fruit Department.....	953	\$1,510 00	\$1,006 25
	Grand totals	5,074	\$17,980 50	\$11,196 06

Report received and referred to the finance committee and the premium list committee.

REPORT OF BUSINESS COMMITTEE.

The business committee reports that the extraordinary exhibit in sheep and swine made necessary a large outlay for accommodations. It was thought important in view of the lack in 1901 of facilities for feeding the people, to provide a tent and kitchen in addition to the room under the grand stand. Under the circumstances this outlay was not needed. The closets were put in order and galvanized cans purchased, additional seats were provided for the grand stand at an expense of \$334.53.

The total for buildings and grounds is \$4,198.56 of which more than \$3,000 is for lumber and other material and labor for additional room and improvements.

This is in explanation of the increased expenditures of 1902 over 1901.

A detailed statement of expenditures is herewith submitted. The report together with the statement of expenditures was received and referred to the finance committee.

Business Vouchers in Detail.

Date. 1902.	No. of voucher.	Name.	Amount.
Feb. 19	1	W. P. Custard, expenses winter meeting.....	\$11 30
	2	John A. Hoffman, expenses winter meeting..	9 65
	5	J. E. Rice, expenses winter meeting.....	7 75
	6	John McKay, expenses winter meeting.....	3 00
	7	Frank Maynard, expenses winter meeting....	4 05
	8	F. E. Skeels, expenses winter meeting.....	14 09
	9	Eugene W. Jones, expenses winter meeting..	7 50
	10	John Marshall, expenses winter meeting....	6 25
	11	E. W. Hardy, expenses winter meeting.....	6 79
	12	C. A. Waldron, expenses winter meeting.....	6 70
	13	L. W. Barnes, expenses winter meeting.....	9 25
	14	H. R. Dewey, expenses winter meeting.....	3 30
	15	H. H. Hinds, expenses winter meeting.....	12 22
	16	Geo. H. German, expenses winter meeting....	2 20
	17	Byron E. Hall, expenses winter meeting....	6 08
	18	W. E. Boyden, expenses winter meeting.....	8 25
	19	M. P. Anderson, expenses winter meeting....	13 41
	21	F. L. Reed, expenses winter meeting.....	4 55
	22	M. L. Dean, expenses winter meeting.....	3 10
			<hr/>
			542 35

Business Committee.

Aug. 20	35	I. H. Butterfield, expenses.....	\$55 66
	38	W. E. Boyden, expenses.....	24 45
Sept. 27	98	W. E. Boyden, expenses and salary.....	57 40
	110	Eugene Fifield, expenses.....	69 44
	115	Eugene Fifield, expenses and board.....	24 15
Oct. 10	157	Eugene Fifield, expenses and salary.....	311 25
			<hr/>
			542 35

Advertising Committee.

Sept. 27	111	W. P. Custard, expenses.....	\$22 00
	79	John A. Hoffman, expenses.....	26 70
			<hr/>
			48 70

Amount carried forward..... \$730 49

STATE BOARD OF AGRICULTURE.

Amount brought forward..... \$730 49

Finance Committee.

Sept. 27 108 John McKay, paid clerk..... \$12 00 12 00

Transportation Committee.

Sept. 26 70 H. H. Hinds, expenses..... 10 82
Oct. 10 166 E. Howland, supt., salary..... 30 00
40 82

President's Office.

Aug. 20 39 M. P. Anderson, expenses..... \$35 91
Sept. 27 85 J. W. Cochran, assistant, expenses..... 27 96
95 M. B. Armstrong, services six days..... 12 00
29 113 M. P. Anderson, salary and expenses..... 162 99
238 86

Secretary's Office.

June 2 31 I. H. Butterfield, secretary, part salary..... \$150 00
Sept. 27 86 C. D. Cowles, clerk..... 27 78
129 A. Corwin, clerk 32 00
Oct. 8 130 I. H. Butterfield, clerk hire paid..... 81 50
131 I. H. Butterfield, expenses..... 63 75
135 I. H. Butterfield, paid clerk..... 25 00
Sept. 6 47 I. H. Butterfield, on salary..... 100 00
April 30 26 I. H. Butterfield, expenses..... 18 02
Oct. 9 133 I. H. Butterfield, paid clerk..... 8 24
10 156 I. H. Butterfield, balance salary..... 550 00
1,056 29

Treasurer's Office.

Oct. 10 159 C. W. Young, pay roll help..... \$218 79
163 C. W. Young, treasurer, salary and expenses.. 459 91
678 70

Cattle Department.

Sept. 26 65 J. J. Ferguson, judge, services and expenses.. \$40 68
27 78 H. R. Dewey, supt., salary and expenses..... 62 09
80 M. R. Seeley, judge..... 5 00
107 77

Horse Department.

Sept. 26 68 H. H. Hinds, supt., expenses..... \$27 02
69 W. S. Walker, assistant superintendent..... 16 00
162 I. H. Butterfield, sec., paid Taggart, judge.... 3 00
1903.
Jan. 27 181 H. H. Hinds, superintendent, salary and judge. 32 00
78 02

Amount carried forward..... \$2,942 95

Amount brought forward..... \$2,942 95

Speed Department.

1902.					
June	2	30	Member Michigan Trotting Circuit, D. L. Cutting, treasurer	\$5 00	
Sept.	19	51	Member American Trotting Association.....	50 00	
	23	54	Eugene Fifield, drawn for purses.....	1,500 00	
	26	72	A. Barnard, starting judge.....	60 00	
		74	John Carmody, solicitor entries.....	25 00	
	27	75	Frank Freegard, care of track.....	20 00	
		102	Geo. S. Ward, clerk races.....	124 10	
		109	P. Tierney, rebate on pool sale.....	40 00	
		114	J. F. Rundell, assistant and expenses.....	50 50	
		115	Eugene Fifield, board judge.....	13 60	
Oct.	10	123	Geo. S. Ward, to pay advertising bills.....	81 60	
	25	171	C. W. Young, paid rent time announcer.....	1 90	
				<hr/>	1,971 70

Sheep Department.

Sept.	25	55	A. A. Wood, judge.....	\$16 50	
	26	71	Wm. Ball estate, expenses.....	7 45	
		77	Erwin W. Ball, superintendent and salary....	40 20	
		62	C. A. Phelps, judge.....	40 50	
					104 65

Swine Department.

Sept.	25	56	L. W. Dehwart, judge.....	\$30 00	
	27	90	L. W. Barnes, supt., salary and expenses....	58 50	
					88 50

Poultry Department.

Sept.	27.	100	C. A. Waldron, superintendent, salary and expenses and judge	\$73 64	73 64
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Farm and Garden Produce Department.

Sept.	27	108	John McKay, supt., salary and expenses.....	63 20	63 20
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Dairy Department.

Oct.	9	138	John Marshall, supt., salary and expenses...	66 00	66 00
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Farm Implement and Machinery Department.

Sept.	27	79	John A. Hoffman, supt., salary and expenses.	79 71	
Oct.	22	170	C. W. Young, treasurer, paid expenses judge.	10 00	
					89 71

Vehicle Department.

Oct.	27	81	J. E. Rice, supt., salary and expenses.....	\$48 65	48 65
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Art Department.

Sept.	27	76	Byron E. Hall, supt., salary and expenses and judge	94 86	94 86
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Amount carried forward..... \$5,543 86

STATE BOARD OF AGRICULTURE.

- Amount brought forward..... \$5,542 86

Needlework Department.

Oct. 10 137 Mrs. F. E. Skeels, supt., expenses and services \$31 48 31 48

Horticultural Department.

Aug. 20	41	M. L. Dean, assistant supt., expenses.....	4 53	
Sept. 26	64	M. L. Dean, paid judges and help.....	42 00	
27	94	Geo. H. German, supt., salary and expenses...	38 00	
23	116	Pontiac Cold Storage Co., storage.....	25 15	
Oct. 1	120	M. L. Dean, ass't supt., expenses and services.	60 68	
				170 36

School Department.

Sept. 27 87 Frank Maynard, supt., salary and expenses.. \$69 86 69 86

Gate Department.

Sept. 27	84	W. P. Custard, supt., pay roll.....	286 98	
	111	W. P. Custard, supt., salary and expenses....	62 16	
				349 14

Police Department.

Sept. 27	82	E. W. Hardy, supt., pay roll.....	\$811 14	
	91	E. W. Hardy, supt., salary and expenses.....	49 93	
Oct. 10	145	E. W. Hardy, supt., supplementary pay roll...	21 95	
				883 02

Main Building and Privileges.

Aug. 19	37	F. E. Skeels, supt., expenses.....	\$60 29	
Sept. 28	107	F. E. Skeels, supt., expenses.....	106 50	
				166 79

Postage Account.

Mar. 24	24	I. H. Butterfield, secretary, stamps.....	\$11 00	
July 1	32	H. A. Wyckoff, postmaster, stamps.....	50 00	
Aug. 20	36	H. A. Wyckoff, postmaster, stamps.....	50 00	
Sept. 6	45	I. H. Butterfield, secretary, stamps.....	29 88	
April 30	26	I. H. Butterfield, secretary, stamps.....	10 00	
Oct. 9	134	I. H. Butterfield, secretary, stamps.....	1 09	
Dec. 22	177	I. H. Butterfield, sec., stamps and envelopes..	64 28	
				216 25

Printing and Stationery Account.

Feb. 17	3	Lawrence & Van Buren, printing vouchers...	\$5 00	
Mar. 24	23	Lawrence & Van Buren, printing letter heads and envelopes	54 30	
Sept. 27	101	Lansing Printing Co., tickets and cards.....	44 75	
Oct. 10	121	C. & J. Gregory, tickets.....	22 75	
	9	134 I. H. Butterfield, sec., sundry stationery.....	1 42	
		149 Pontiac Daily Press, sundry printing.....	50 15	
		150 Pontiac Gazette, sundry printing.....	65 50	
	10	162 I. H. Butterfield, sundry stationery.....	7 25	
		158 C. W. Young, treasurer, sundry printing.....	6 00	
	3	119 C. W. Young, treasurer, bills paid.....	25 50	
				282 62

Amount carried forward..... \$7,713 33

Amount brought forward..... \$7,713 33

General Expense Account.

July 24	33	Byron E. Hall, mileage, acc't Maccabee Day.	\$20 00	
Sept. 27	83	Byron E. Hall, supt., to pay prize Maccabee drill	381 00	
	105	F. W. Burch, serviecs.....	18 75	
	99	Pontiac Citizens' Band, music.....	144 00	
Oct. 9	133	Fred Foster, labor.....	8 73	
		Edith Andrews, stenographer	7 00	
	25	171 R. Bartlett, straw for walks.....	4 50	
	10	160 Joseph Shotwell, straw for walks.....	45 00	
		164 Chas. Durkee, straw for walks.....	9 00	
		167 Frank Watchpocket, straw for walks.....	65 00	
		144 F. J. Stuart & Co., straw and feed.....	308 22	
		151 The T. W. Noble Co., decorating buildings....	408 47	
1903.				
Jan. 27	180	F. E. Skeels, pay roll, labor.....	23 75	
				1,443 42

Buildings and Grounds.

1902.				
Aug. 28	43	The Detroit Mill, lumber.....	\$188 55	
	23	44 Howland Mfg. Co., stakes.....	16 10	
Sept. 8	48	F. E. Skeels, labor pay roll.....	210 40	
	9	49 Buhl Stamping Works, cans for closets.....	63 00	
	27	128 L. J. Holser, pipe and repairs.....	5 78	
		106 Geo. Gilboe, stone for road.....	40 00	
Oct. 9	132	I. H. Butterfield, sec., labor paid.....	18 06	
		133 I. H. Butterfield, sec., freight paid on lumber.....	19 32	
		139 Waite Bros. & Robertson, cloth, etc.....	33 96	
		140 L. J. Holser, pipe and materials.....	13 30	
		141 F. J. Poole, lumber and roofing.....	665 59	
		146 Onyx Paint Co., paint.....	65 50	
		147 E. J. Hallett, hardware, nails, etc.....	274 82	
		148 John Bell & Sons, lumber.....	48 00	
		152 Millis Bros., lumber	116 80	
		153 F. E. Skeels, pay roll, labor.....	173 55	
		154 F. E. Skeels, pay roll, labor.....	389 63	
		155 F. E. Skeels, pay roll, labor.....	773 71	
		161 A. A. Corwin, lumber.....	600 00	
		165 F. E. Skeels, services.....	100 00	
		166 E. Howland & Sons, seats for grand stand....	334 53	
	25	171 C. W. Young, treas., paid Onyx Paint Co.....	28 28	
Nov. 25	172	C. W. Young, paid E. R. Styles, labor.....	5 63	
	25	173 C. W. Young, treas., paid labor.....	14 15	
				4,198 66

Attractions.

Sept. 27	97	D. H. Harris, Madam Marantate.....	\$350 00	
	93	The Rexos	100 00	
	92	The Norins	300 00	
	88	Wm. E. Bickett	500 00	
	73	L. F. Sunlin	300 00	
	67	Saginaw Fire Department, expenses.....	66 20	
	26	66 Port Huron Fire Department, expenses.....	45 68	
	25	57 H. C. Devlin, military company.....	175 00	
	27	112 G. H. Turk, expenses fire teams.....	186 00	
	22	169 G. R. & I. R. R., freight on fire teams.....	46 82	
	27	115 Eugene Fifield, expenses firemen.....	9 80	
Oct. 22	170	C. W. Young, paid freight bill.....	2 68	
	25	171 C. W. Young, paid expenses Detroit team.....	10 92	
				2,093 10

Amount carried forward..... \$15,448 51

Amount brought forward..... \$15,448 51

Telegraph and Telephone, Freight and Express.

Feb. 19	4	F. W. Burch, freight paid.....	\$4 50	
Mar. 26	25	American Express, express on stationery.....	5 10	
April 30	26	I. H. Butterfield, telephone bills paid.....	1 83	
Sept. 30	118	American Express, express bills.....	41 55	
Oct. 9	133	I. H. Butterfield, sec., f'r't and telegraph bills.	11 48	
	134	I. H. Butterfield, sec., f'r't and telegraph bills.	16 94	
Nov. 26	174	Michigan Telephone Co., rent and service...	28 45	
Oct. 10	158	C. W. Young, treas., telephone bills paid.....	79	
				110 64

Advertising.

April 3	29	T. G. Adams, page in pamphlet.....	\$5 00	
July 25	34	Lawrence & Van Buren, cloth posters.....	13 75	
Sept. 2	46	Michigan Lithograph Co., Harris lithographs..	13 75	
15	50	The Hayes Lithograph Co., hangers, fans, etc.	262 00	
	52	The Calvert Lithograph Co., cards, etc.....	40 19	
12	53	C. W. Young, treas., advt. bills paid.....	41 15	
25	58	C. W. Young, treas., advt. bills paid.....	58 35	
	59	C. W. Young, treas., advt. bills paid.....	75 35	
	60	C. W. Young, treas., advt. bills paid.....	43 89	
	61	C. W. Young, treas., advt. bills paid.....	51 20	
	63	Detroit Free Press Ptg. Co., posters.....	55 00	
	96	Edgar Noble, distributing advertising.....	15 00	
27	103	Geo. M. Savage, 220 papers ads.....	375 00	
30	117	Evening News Association, page advertisement	310 00	
Oct. 3	119	C. W. Young, treas., advt. bills paid.....	101 20	
9	122	Michigan Farmer, advertising	52 92	
17	124	The Mulford & Petry Co., cards in cars.....	30 00	
18	125	Detroit To-Day, page advertisement.....	92 85	
9	135	I. H. Butterfield, sec., paid posting bills.....	41 43	
10	136	C. W. Young, treas., bills paid.....	62 65	
10	142	Detroit Free Press, page and advertising....	302 50	
10	143	The Detroit Journal Co., page and papers....	332 50	
9	149	Pontiac Daily Press, advertising.....	108 50	
10	150	Pontiac Gazette, advertising	190 66	
Nov. 29	175	C. F. Wortman, banner at Fenton.....	5 00	
5	172	C. W. Young, treas., bills paid.....	25 27	
Oct. 9	133	I. H. Butterfield, sec., bills paid.....	16 70	
22	170	C. W. Young, treas., bills paid.....	4 40	
10	162	I. H. Butterfield, sec., bills paid.....	14 00	
	158	C. W. Young, treas., bills paid.....	24 80	
9	134	I. H. Butterfield, sec., bills paid.....	1 25	
				2,766 26

Ribbons and Badges.

Sept. 25	104	Armstrong Regalia Co., prize ribbons.....	\$113 60	
Oct. 9	133	I. H. Butterfield, sec., button badges.....	7 00	
9	139	Waite Bros. & Robertson, ribbons and buttons.	9 60	
				130 20

Amount carried forward..... \$18,455 61

Amount brought forward..... \$18,455 61

Sundry Expenses.

Feb. 19	20	Losee Bros., boots for workmen.....	\$3 00	
April 27	27	C. W. Watkins & Co., sec., bond premiums..	7 50	
	3	C. W. Young, treas., treasurer's bond.....	40 00	
Aug. 20	40	The Fred Macy Co., office desk.....	27 50	
	30	John Irvine & Sons, flowers Mr. Ball's funeral.	15 00	
Sept. 25	89	J. A. Austin, usher grand stand.....	5 81	
	27	E. Fifield, punches	2 00	
Oct. 3	127	Church & Linabury, linoleum.....	11 30	
	9	I. H. Butterfield, supplies.....	8 20	
	10	C. W. Young, paid repair ticket boxes.....	3 60	
	13	I. H. Butterfield, stall rent refunded.....	1 40	
	168	C. W. Young, treas., paid guessing prizes.....	50 00	
Nov. 5	172	C. W. Young, treas., brooms.....	1 55	
	25	C. W. Young, treas., paid bills.....	3 50	
Dec. 20	176	I. H. Butterfield, sec., sundry expenses paid..	30 62	
Oct. 3	126	F. L. Elliott, tables and chairs.....	10 25	
				221 23

Premiums Paid.

1903.				
Jan. 27	178	To C. W. Young, premiums paid.....	\$11,340 81	
	179	To Calvert Lithograph Co., diplomas printed..	25 00	
				11,365 81
Total				\$30,042 65

SUMMARY.

Executive Committee, expenses winter meeting.....	\$139 44
Business Committee, salary and expenses.....	542 35
Advertising Committee, expenses	48 70
Finance Committee	12 00
Transportation Committee	40 82
President's Office, salary and expenses.....	238 86
Secretary's Office, salary, expenses and clerks.....	1,056 29
Treasurer's Office, salary, expenses and clerks.....	678 70
Cattle Department	107 77
Horse Department	78 02
Speed Department, purses, advertising, clerks, etc.....	1,971 70
Sheep Department	104 65
Swine Department	88 50
Poultry Department	73 64
Farm and Garden Department.....	63 20
Dairy Department	66 00
Farm Implement Department	89 71
Vehicle Department	48 65
Art Department	94 86
Needlework Department	31 43
Horticulture Department	170 36
School Department	69 86
Gates Department	349 14
Police Department	883 02
Main Building and Privileges	166 79
Postage	216 25
Printing and stationery	282 62
General expenses	1,443 42
Buildings and grounds	4,198 66
Advertising	2,766 26
Attractions	2,093 10
Telegraph, telephone, freight and express.....	110 64
Ribbons and badges	130 20
Sundry expenses	221 23
Premiums and diplomas	11,365 81

REPORT OF THE TREASURER.

Receipts and Expenditures for the year 1902.

Amount on hand February 18, 1902.....		\$18,912 49
Sept. 26. Received from sale of admission tickets.....	\$9,626 45	
" " sale of railroad coupon tickets....	4,211 75	
" " sale of grand-stand tickets.....	1,002 75	
" " F. E. Skeel's privileges.....	2,548 01	
" " Detroit United railway, donation.	50 00	
" " American Short Horn association	483 00	
" " secretary, stall fees.....	374 80	
" " secretary, membership.....	678 00	
" " speed department.....	975 00	
" " score card and pools.....	125 00	
" " E. Fifield	98 31	
" " F. J. Poole, donation.....	6 65	
" " J. A. Hoffman, rebate on railroad	2 88	
" " E. Fifield	3 00	
" " checks on overpaid prem. vouchers	4 75	
" " A. C. Rich.....	1 60	
" " state appropriation	4,500 00	
		24,691 95
		<u>\$43,604 44</u>

The report was received and referred to the finance committee.

Report of the Finance Committee.

Pontiac, January 28, 1903.

Officers and Members of the Executive Committee of the Michigan Agricultural Society:

Gentlemen—Your finance committee to whom was referred the reports of the secretary and treasurer of this society would respectfully report that we have thoroughly examined and compared the same and that we find the same correct.

JOHN McKAY,
H. R. DEWEY,
F. E. SKEELS,

Finance Committee.

Pontiac, January 28, 1903.

We would also further report that we have examined the report receipts and contract books of the superintendent of privileges and find the same correct as reported by the superintendent and treasurer.

JOHN McKAY,
H. R. DEWEY,

Finance Committee.

On motion the executive committee of 1902 adjourned sine die.

The executive committee and officers elect were called to order by President Howland.

Roll called and the following members responded: Pres. E. Howland, Treas. C. W. Young, Sec'y I. H. Butterfield, members of executive committee, Messrs. Fifield, Boyden, Barnes, Dewey, Ball, Hinds, Dean, Rice, Hoffman, Custard, Maynard, Waldron, German, McKay, Collier, Hardy, Jacobs, Marshall, Skeels.

President Howland read his address as follows:

ADDRESS OF PRESIDENT HOWLAND.

Members of the State Agricultural Society:

It is very embarrassing to me, gentlemen, to be called on to take the position so lately filled by so worthy and talented a gentleman as our retiring president.

There is also another cause of embarrassment, gentlemen, in taking the chairmanship of your committee, while I know it to be both customary and appropriate for your president to point out defects and recommend remedies in the business methods of the organization, it is well known by a majority of your members who are veterans in the society's service, that I have not had the experience in the management of the society's affairs that would entitle advice from me to your highest consideration; therefore, I will aim to make only such propositions as carry weight by their own self-evident nature.

I deem it, gentlemen, to be our first duty to take action in honor of the memory of our lately deceased brother, the Hon. Wm. Ball, for whose service the society owes its deepest gratitude, and the memory of whose companionship must be very dear to the older members of this committee.

The business of the past being now adjusted, the future is before us and knowing as all concerned do that the contract for accommodations for holding the fair has expired it would seem to me that arrangements for accommodations for a fair in 1903 should be the first business question considered and while I may be censured for being too much interested to make an unselfish recommendation on the question, I feel constrained to say that I do not think a removal from Pontiac at least for the coming year should be a debatable question, provided reasonable terms can be obtained of those having in charge the grounds and buildings lately used by the society.

I base my position on this question on the following reasons: It is now by all odds the best equipped grounds in the state. It stands in evidence that the location is a favorable one for holding a successful fair. The society has three or four thousand dollars invested upon the grounds and the citizens of Pontiac deplore the weather conditions which robbed them of their cherished hopes of seeing the State Fair of 1902 an unprecedented success. Other affirmative reasons could be cited which I will not now take the time to give.

SUPERINTENDENT OF PRIVILEGES.

I would suggest that the committee discuss the propriety of requiring bonds of the superintendent of privileges. It being well understood that this department collects a large sum of money which, unlike the funds of the secretary and treasurer, is unprotected by bonds.

I would also recommend that a system be inaugurated whereby it would become the secretary's duty to issue licenses for privileges, upon order of the superintendent, describing the privileges granted, the amount received and such other information as might be necessary to make it a clearly understood transaction.

I think such a record would be valuable for superintendents to refer to, in disposing of privileges, besides being a safeguard for the transaction of the business. I would make this recommendation with no reflection on business of the past, but purely in the interests of the future.

MAIN BUILDING.

I believe it has been customary to grant a large space in the main building to one individual for a simple membership fee, while their object is to use it for a place of business. I call your attention to this, thinking perhaps that after a limited amount of space has been granted on a membership ticket, the balance of space desired should be disposed of to the best advantage.

TIME OF FAIR.

I wish to offer some suggestions in regard to the time of holding the fair, with reference to periods of the moon's changes—while I am not in possession of any proof of a scientific nature; I am impressed with the idea that you get more than an ordinary amount of settled weather for a time just preceding the full moon than at other periods in the moon's changes. Should you differ for me, gentlemen, on this point, I think the advantage of this period in the way of moonlight nights would entitle the suggestion to some consideration.

DURATION OF FAIR.

I shall now propose an idea which would be an innovation on the custom and established rules of the society. It has both a moral and a business aspect. My proposition is to have the fair begin about Wednesday or Thursday and continue until some period the next week, which might seem advisable, holding the exhibition open on Sunday, discontinuing racing, and suppressing noisy and rude demonstrations.

The moral view, is it any worse to hold the exhibition open for the purpose of being viewed by visitors after being all in place and being quietly cared for by attendants than as at present—Sunday being the busiest day of preparation of any day of the fair, and the following Sunday being largely spent reloading exhibits and getting away.

The business advantages would be, in case a longer period than has been used for holding the fair is desired on account of unfavorable weather, or any other cause it could be prolonged in the next week, but the main advantage to be expected would come, if the fair is held in

Pontiac, in giving the immense factory population of both Pontiac and Detroit opportunity to attend on Sunday. The factories especially in Detroit not closing for the fair. The magnitude of this population must be very great as I saw a published statement that there had been forty factories in the city of Detroit costing over ten thousand dollars each, erected and put in operation during the past year.

The question of permanent location is becoming an interesting one to this society. I believe it to be for the best interests of the society to locate, if not permanently, for a term of years sufficient to make it an object to make improvements of a better and more permanent nature. I believe, if the society owned grounds and buildings it would add to its dignity and standing which would be very desirable.

On motion, the addresses of the retiring and incoming presidents were referred to a committee of three; J. E. Rice, H. H. Hinds, W. P. Custard. The president appointed committee on premium list as follows: Young, Butterfield, Hinds, Hoffman, Rice, McKay, Dean; on rules, Skeels, Custard, Barnes.

A recess was taken to Thursday, January 29, at 11 o'clock a. m.

Thursday, January 29, 11 o'clock a. m.

Committee met. All members present.

Mr. Hinds moved that the fair be held in Pontiac this year if the same arrangements can be made as for two years past. The motion not being seconded was not put.

On motion of Mr. Collier, Mr. George Grant, secretary of the Saginaw Board of Trade, was invited to meet the committee. Mr. Grant presented an invitation from the Board of Trade of Saginaw to consider a proposition to hold the annual fair at Saginaw.

Mr. Collier and Mr. Fifield were appointed a committee to tender thanks, through Mr. Grant, to the Saginaw Board of Trade for the invitation.

A communication was also received from the Kent County Agricultural Society to hold the fair of 1903 on the grounds of that society at Grand Rapids. The communication was accepted and referred to the committee on location and the secretary was instructed to acknowledge receipt of the same and tender the thanks of the committee.

Mr. Skeels moved that a committee of seven be appointed by the president to consider proposals for holding the next fair, and to report their findings and recommendations to the executive committee as early as possible. Carried.

Mr. Young moved that the legislature be asked to make an appropriation of \$5,000 per year for premiums to be awarded at the fairs of 1903 and 1904. Carried.

Mr. Collier moved that a legislative committee comprised of the same members as served in 1901, any vacancies to be supplied by appointment by the president, be created for the year 1903. Carried.

The president appointed committee on location of fair: Messrs. Young, Fifield, Collier, Hoffman, Butterfield, Custard, Anderson.

Mr. C. S. Bartlett of the Oakland Grange appeared before the committee and made a proposition for the society to provide a tent for Grange headquarters, to be in charge of a committee of the Grange and to be used by the people generally as a "rest" tent during the fair.

Referred to the business committee. Later the business committee agreed with Mr. Bartlett to provide a tent for the purpose named, the Grange agreeing to seat and provide attendants.

The committee on address of retiring and incoming presidents reported as follows:

To the President and Executive Committee of the State Agricultural Society:

Gentlemen—The committee to whom was referred the addresses of the outgoing and incoming presidents would respectfully report as follows: Retiring President Anderson's address is a very able paper and is characteristic of the gentleman who has so ably served the Michigan State Agricultural Society as a member of the executive committee for twenty-one years. Its encouraging and conservative thought we commend to the careful consideration of every member of the executive committee. The chief thought of the address regarding a permanent location will soon claim the attention of the executive committee, and the state legislature as well. But until aid is offered by the state, a permanent home for the State Fair cannot in the nature of things be installed.

Incoming President Howland's address is an entertaining and an interesting paper that shows careful thought. His suggestions as to the chances of good weather depending on the moon's phases your committee does not desire to discuss. The suggestion that the superintendent of privileges or other officers of the society handling large sums of money belonging to the society should furnish bonds is endorsed, also that proposing to charge for space in the main building where more than the usual space is used by one exhibitor.

The suggestion of holding the fair over Sunday is respectfully referred to the committee of the whole. The experiment has been tried in New York, Ohio and Michigan and has been abandoned, the objection being that it used up two weeks of the exhibitor's time and the ordinary showman cannot afford so long a time for one fair.

Respectfully,

J. E. RICE,
H. H. HINDS.
W. P. CUSTARD,
Committee.

The report was received and referred to the committee of the whole.

It was moved that \$25 be appropriated for prizes in stock judging provided the Agricultural College offer the same sum, details to be arranged by the secretary and Prof. Shaw of the college. Carried.

The president appointed committee on premium list: Messrs. Young, Butterfield, Hoffman, Hinds, McKay, Dean, Rice; on rules: Messrs. Skeels, Custard, Barnes.

A communication was received from the Stock Exhibitors' Union relating to the freight rates on railroads for live stock to be exhibited at fairs,

and referred to the committee on transportation who are instructed to aid the union in any way which may help to secure better rates.

A recess was taken to one o'clock p. m., when committee met.

The premium list committee reported, making some changes in and additions to the list. It was moved to adopt if the state appropriation was made.

It was moved that if the state appropriation was not made the president call the premium list committee together to revise the list, such action to be final. Carried. This action was later reconsidered and the revision placed in the hands of the president and secretary.

On motion of Mr. Skeels, the salary of general superintendent was made \$300, of treasurer \$400, and secretary \$1,000.

On motion of Mr. Anderson, the salary of second member of business committee was made \$100.

It was moved to lay pipe for water to the farm implement field. Carried.

Committee on rules reported a revision of the rules with some changes. Report accepted and adopted. The reports of the committee on premium list and rules constitutes the premium list of 1903 as printed.

The business committee was authorized to issue an illustrated souvenir and premium list for 1903 at an expense of \$2,000 or less.

The date of the fair for 1903 was fixed for September 7 to 11, inclusive.

The committee on location reported as follows: Your committee on location of the next fair would report that they have conferred with the representatives of the Oakland County Agricultural Society and would recommend that the fair of 1903 be held at Pontiac on the grounds of the Oakland County Agricultural Society on the following terms: The society to pay for the use of grounds and buildings \$1,000 rent and ten per cent net receipts of the fair, also the rent on ground leased.

C. W. YOUNG,

Chairman.

The report was accepted and adopted.

The election of general superintendent was taken up and Eugene Fifield was elected.

John A. Hoffman was elected member of the business committee.

It was moved that live stock entries close fifteen days before the fair and that those of fruits and flowers close on Monday, September 7. Carried.

The president announced the appointments of committees and superintendents for 1903 as follows:

STANDING COMMITTEES AND EXECUTIVE SUPERINTENDENTS.

BUSINESS.

Eugene Fifield, John A. Hoffman, I. H. Butterfield.

TRANSPORTATION.

F. G. Jacobs, H. H. Hinds, E. W. Hardy.

PROGRAM.

H. H. Hinds, George H. German, Secretary.

PRINTING AND ADVERTISING.

Eugene Fifield, John A. Hoffman, I. H. Butterfield.

FINANCE.

John McKay, H. R. Dewey, Geo. H. German.

PREMIUM LIST.

C. W. Young, I. H. Butterfield, J. A. Hoffman, H. H. Hinds, John McKay, M. L. Dean, J. E. Rice.

RULES.

F. E. Skeels, W. P. Custard, L. W. Barnes.

RECEPTION.

Stephen Baldwin, W. W. Collier, M. P. Anderson.

EXECUTIVE SUPERINTENDENTS.

General Superintendent—Eugene Fifield.

Chief Marshal—H. H. Hinds.

Cattle—W. E. Boyden.

Horses—other than speed—C. A. Waldron.

Horses—speed—Eugene Fifield.

Sheep—H. R. Dewey.

Swine—L. W. Barnes.

Poultry—C. A. Waldron.

Ass't Superintendent—Daniel Thomas, Pontiac.

Farm and Garden Products—E. W. Hardy.

Dairy, Bees and Honey—John Marshall.

Vehicles—J. E. Rice.

Agricultural Implements and Machinery—John A. Hoffman.

Main Building—Manufactures and Miscellaneous—F. E. Skeels.

Art—Byron E. Hall.

Needle Work and Children's Work—Mrs. F. E. Skeels, Harriette.

School Exhibits—Frank Maynard.

Horticulture—M. L. Dean.

Gates—W. P. Custard.

Police—E. N. Ball.

Forage—Geo. H. German.

Concessions and Privileges—F. G. Jacobs.

Transportation—F. G. Jacobs.

On motion adjourned.



WILLIAM CHAMBERLAIN.



WILLIAM L. WEBBER.



GEO. W. PHILLIPS.



WILLIAM BALL.



DEXTER HORTON.



JOHN LESSITER.

SKETCHES OF DECEASED MEMBERS

of the executive committee of the Michigan State Agricultural Society who died during the year ending September, 1902.

Hon. William Chamberlain was born at Pembroke, New Hampshire, In 1836 the family moved to Concord, N. H., and in 1843 to Berrien county, Michigan, where they soon settled near Three Oaks and cleared the farm which Mr. Chamberlain still owned at the time of his death. He was also for nearly thirty years engaged in mercantile business with his brother, Hon. Henry Chamberlain, and others in Three Oaks. His education was obtained in the district school but he became a well disciplined and broad minded man.

He held many offices in the school district, township and village, was postmaster from 1865 to 1870, superintendent of the county poor for many years, member of the house of representatives in 1871-73, state senator in 1879-81, and president pro tem. in 1881, a member of the commission to revise the tax laws in 1876, was member of the prison board from 1885 to 1893, and warden of Jackson prison from 1893 to the time of his death.

He was elected a member of the executive committee of this society in February 7, 1834. He was the son of Moses and Mary Foster Chamberlain. 1880 and elected president in 1885 serving for the years 1886-87, also being ex-officio a member of the committee since that time. He was always active in the work of the committee and society and commanded a large influence in its proceedings.

He was one of the strong men of the state, an honorable, christian gentleman, known, honored and respected throughout the State.

He died suddenly from an attack of heart trouble at the Great Northern hotel, Chicago, November 7, 1901, while enroute to attend a meeting of the National Prison Congress at Kansas City. His wife, Mrs. Caroline S. Chamberlain, and five children survive Mr. Chamberlain.

Hon. Wm. L. Webber was born at Ogden, Monroe county, New York, July 19, 1825. In 1836 he came to Michigan with his parents who settled on a farm in Hartland, Livingston county. During his boyhood he attended school in winter and worked on the farm in summers. At nineteen he began teaching school. At twenty his mother died and he then left home and started out for himself, entering the office of Drs. Foote and Mowry at Milford, Michigan, to study medicine where he remained two years. He then abandoned the study of medicine for law. For the next four years he taught school, spending his spare time in the study of law, and in 1851 he opened a law office in Milford where he remained two years. He then went to Saginaw where he practiced law, and was for many years attorney of the F. & P. M. railroad.

He held the offices of prosecuting attorney, mayor of Saginaw, state senator in 1874, and was the democratic candidate for governor in 1876. He was prominent in railroad and business affairs in Saginaw and was well known and respected throughout the state.

He was always interested in agricultural pursuits and for many years conducted a farm, having at one time a herd of Ayrshire cattle.

In 1892 he was appointed by Governor Winans chairman of the board of highway commissioners to formulate a plan of legislation looking to the improvement of the state highways, resulting in the present county road system. He was instrumental in organizing the Michigan League for good roads and was elected its president.

Mr. Webber was elected a member of the executive committee of this society in 1876 and continued a member to 1878 when he was elected president. He was a strong advocate of the educational value of well conducted fairs.

Mr. Webber was a man of the highest character as a citizen and public man and his example is worthy of emulation.

Hon. Geo. W. Phillips was born in Livingston county, New York, July 17, 1829. He was the son of Ira Phillips and Martha Day Phillips, who came with their family to Michigan in 1831 and settled on section 19, Armada, Macomb county. Ira Phillips died in 1855 and the son Geo. W. came into possession of the farm which he retained till his death. February 10, 1856, he married Lydia E. Sterling, daughter of Azariah W. Sterling of Romeo, Michigan. Eight children were born to them, six of whom are still living.

Mr. Phillips while yet a young man became interested in improved live stock and with his father purchased the first pure bred Shorthorn bull brought into Macomb county, and showed him at the first State Fair in 1849.

He was elected to the executive committee of the State Agricultural Society in 1868 and its president in 1880. In 1871 he was appointed member of the State Board of Agriculture and held that office for twelve years. He was active on the board as member of the farm committee and largely instrumental in the organization of farmers' institutes, the first institute being held in his home township, Armada, in 1876. As a member and president of the State Agricultural Society, he was active and prominent in all its work.

He was active also in the county and district agricultural societies of Macomb county, the state and county Shorthorn cattle breeders' associations, and the Armada Farmers' Club, which was one of the first farmers' clubs organized in the state.

He was active in all social and religious movements in his section, and his neighbors relied on him and his family for counsel and aid in all emergencies and he never failed them even to his own inconvenience.

Generous to a fault, patriotic and public spirited, always eager to help the needy, were characteristics which endeared him to a large circle of friends who mourn his loss. He leaves a memory of which his children may be proud, and which a large circle of friends and neighbors will cherish as of one who has done his best to make the world blessed.

Hon. William Ball was born in Niles, Cayuga county New York April 7, 1830. When he was six years of age his parents came to Michigan, settling in the township of Webster, Washtenaw county. His early life was similar to that of the average farmer's son, although the indomitable will that has made him a prominent figure, not only in the line of his specialties in rural life, but in politics as well, were manifest in him throughout his youth.

At the age of nineteen young Ball began earning money by teaching, following the profession most of the time for ten years, during which period he took a preparatory course at Albion college. He entered the

University in 1855, but after a year in the literary department accepted the principalship of the graded school at Otisco, Ionia county, where he remained two years.

During his term as principal, Mr. Ball purchased a farm of 150 acres in the township of Hamburg, Livingston county, and when he resigned the position in 1858 began his chosen life work. His property was gradually added to until at one time he operated a farm of 700 acres in extent. He was an excellent farmer and a prominent breeder of American Merino sheep and Shorthorn cattle. He held the office of president of the Merino Sheep Breeders', the Shorthorn Cattle Breeders', and the Improved Live Stock Breeders' associations.

He took an active part in politics, was an ardent republican and served in 1865, 1867 and 1881 as representative in the state legislature, and as senator in 1889, and was elected president pro tem. and owing to the death of the lieutenant governor became acting lieutenant governor. In 1890 he was the republican candidate for congress from the sixth district and was defeated by a small majority.

In 1878 he was selected member of the executive committee of this society and served continuously until in 1892 he was elected president, serving till 1898 when he was again elected to the executive committee continuing a member till his death, thus serving the society continuously from 1878 to 1902, twenty-four years. His death occurred at Ann Arbor, August 28, 1902. Mr. Ball was positive in his opinions, honest and straightforward in all his dealings. He leaves the record of a self made man, a true and honorable citizen of his adopted state.

Dexter Horton was born in Groveland, Oakland county June 24, 1836. His early education was obtained in the common schools and in Albion college. On attaining his majority he settled at Fenton and was appointed postmaster of that village in 1861. In 1863 he enlisted in the volunteer army and in 1864 was appointed captain by President Lincoln. For meritorious conduct he was later appointed major of volunteers. After the war he was reappointed postmaster at Fenton. In 1867 he was assistant sergeant-at-arms of the state senate and in 1869 representative from his district. In 1888 he was again postmaster at Fenton. He served as village president, member of the Fenton school board for fifteen years, and commander of Col. Fenton G. A. R. post for seven years, was delegate to the national republican convention in 1868. He served as president of the Fenton Agricultural Society, the Genesee County Pioneer Association, and of numerous fraternal and business associations. In 1861 he married Miss Lavinia Losee, who survives him.

Major Horton was elected a member of the executive committee in 1899, and was superintendent of the vehicle department.

His death occurred at Fenton, December 28, 1901. Major Horton was one of the most genial and companionable of men, a true citizen and patriot, and was very popular among the people who knew him best.

John Lessiter was born in Wiltshire, England, July 19, 1827, and came to Michigan in 1847, being six weeks in crossing the ocean. He was reared on a farm and had a good common school education. He began for himself by working by the month, soon renting a farm, and in 1853 purchased a tract of land in Orion township which he cleared and improved. He held this farm with additions to his death, having made of it a fine homestead. In 1852 he married Nancy Beardslee who with five children survive him.

He held positions of trust, among them the office of postmaster of Jersey, Oakland county, for thirty years. He was greatly interested in improved live stock breeding and established a fine herd of Shorthorn cattle and flock of Shropshire sheep. He was an active member and officer of the Oakland County Agricultural Society. In 1880 he was elected a member of the executive committee of this society and continued a member to the time of his death, at Pontiac October 23, 1901.

In his private life he was a kind and helpful neighbor, honorable in business, a patriotic citizen, loved and respected by all who knew him.

REPORT OF MICHIGAN STATE GRANGE FOR YEAR ENDING JUNE 30, 1903.

OFFICERS OF MICHIGAN STATE GRANGE FOR 1902-1903.

Master—G. B. Horton, Fruit Ridge.
 Overseer—N. P. Hull, Dimondale.
 Lecturer—Mrs. Frank Saunders, Rockford, R. F. D.
 Steward—T. E. Niles, Mancelona.
 Assistant Steward—Wm. Robertson, Fremont.
 Treasurer—E. A. Strong, Vicksburg.
 Secretary—Miss Jennie Buell, Ann Arbor.
 Gate Keeper—G. A. Whitbeck, Montague.
 Ceres—Mrs. Annie R. Jones, Lapeer.
 Flora—Mrs. Virginia Halladay, Clinton.
 Pomona—Mrs. Della Proctor, Dansville.
 Lady Assistant Steward—Mrs. Mary Robertson, Fremont.

EXECUTIVE COMMITTEE.

F. W. Redfern, Maple Rapids.....	December, 1903
E. A. Holden, Lansing.....	" 1903
Emory E. Owen, Lapeer.....	" 1903
Thos. Mars, Berrien Center.....	" 1904
A. E. Palmer, Kalkaska.....	" 1904
M. T. Cole, Palmyra.....	" 1904
T. H. McNaughton, Ada.....	" 1904
G. B. Horton, Fruit Ridge; Jennie Buell, Ann Arbor, Ex-Officio.	

Since the last report was made Michigan has entertained the National Grange at Lansing, in November, 1902. A large and profitable gathering of representative agriculturists came from all parts of the country and strengthened the interests of the farm and the bond of fraternity existing among its people. Michigan now ranks second in Grange membership in the union and is being looked to as a leader in certain pronounced methods of progressive Grange work.

The year in this state has been characterized by a strong forward movement in the organizing department. The conditions in agricultural communities for combining forces for effective service have seldom been more favorable. One hundred and twenty-eight new Subordinate Granges have been established, fifteen dormant ones reorganized and three county Granges organized. This work has not alone followed the development of agriculture in the upper counties but many of them have been organized in old farm sections of the state.

It has been the aim of the policy of State Grange to follow this rapid organization with the setting up in each new Grange of as strong systems of cooperative and lecture work as possible. By this means the permanence and real use of the Order is best gained and maintained.

The lines of special educational work being followed in Grange circles in Michigan are clearly set forth in the following extracts from reports of officers at the last state session. From State Master Geo. B. Horton's annual address:—

"The key to Michigan success in Grange work is definite lines of policy systematized, continued from year to year, and then given the amount of labor to win success. It is said by good business men that a poor article in the hands of a good working salesman will meet with better results than an acknowledged good article if left to take care of itself. This being true, how great must be the rewards of labor given to promoting the interests of an organization like the Grange which possesses a high standard of merit. After all it is work thoroughly directed which wins. In this connection your attention is called to our conferences for winter and our rallies for summer work, and which are calculated to pay a good share of our debt to Subordinate Granges for their support and their perpetuity. On the basis that our Subordinate Granges are the stones that form the great foundation wall to the whole Grange structure. it is reasonable to conclude that they must be well laid and supported else a mass of ruins soon follows. To make Subordinate Granges strong and perpetual, two things are necessary. First, all members must have a thorough understanding of the governing laws of the Order and a full knowledge and appreciation of charter and obligation duties and privileges. Each must personally know of all benefits attainable through membership. Second, the principles and purposes of the Order must be kept continually before all farmers of the state to the end that gradually from year to year the ranks of each Grange may be reinforced with new energy and new life.

To accomplish the first the winter conferences are planned. They are intended to fill the needs of inspection service, schools of instruction, and in presentation of such methods of the every day home life of a Grange as will lead to greatest success. The conference is a right down heart to heart dealing with the common things essential to the life and success of a Grange. Taking the conference as a correct basis the detail methods of procedure and program can be changed and improved from year to year as the best help to Grange maintenance may suggest.

To accomplish the second necessity to Grange perpetuity, the system of summer or August rallies are planned and encouraged. This being the season of picnics, farmers give liberal attendance at all such public gatherings and thus our Grange speakers are given a good hearing. The conference deals with the inner life of the Grange while the rally appeals to the public.

To the conference the State Grange sends a conductor and referee and pays all expenses except for meeting place and entertainment of attendants. To each rally the State Grange sends the chief speaker and pays his or her expenses and per diem, except a specified amount. Dates of both rallies and conferences together with the routing of speakers is conducted by the State Grange.

These lines of work are growing in popular favor with Granges as proven by the greatly increased number of meetings held under the

auspices of each system during the past year. The design has been to so completely cover all parts of the State that no Grange will be at an objectionable distance from both forms of meetings. Patrons everywhere and as a whole should anticipate all efforts of the State Grange where local help is contemplated and by attendance give added strength to such efforts."

The history of the changes in lecture work inaugurated within a few years is described by State Lecturer, Mrs. F. D. Saunders:—

"While in the past the State Lecturer depended entirely on the personal visit among the Granges to impart instruction, suggest new work and in general enthruse to greater activity, the new plan was to do all this by and through the printed page. And so it came about that in January 1899, the Michigan State-Grange Lecturer's Bulletin, dated Vol. 1, No. 1, bearing the motto "Work to Succeed" found its way into every Grange in the State by way of the Subordinate Lecturer. At the end of the first year's work we were authorized to appear in an enlarged form of four pages, containing programs for two meetings each month and to devise some method of getting returns from the Subordinate Lecturers.

The plan devised was that of sending out with each issue of the Bulletin a two page supplement sheet to be returned to us at the end of each quarter containing information bearing upon the lecture hour in each Grange. The information gained in these reports proved the wisdom of the course. One year ago the supplement sheet was enlarged to four pages with additional headings concerning distinctive lecture work, viz., extension work, essay writing, discussion of topics, suggestions, queries and monthly reports asked for. These supplement reports furnished the Lecturer's News Department, a feature of the bulletin during the past two years, which disseminates to all the lecturers a successful program carried out by any one lecturer. We believe this one wrought out plan has proven of great benefit to the lecturers in giving ideas of diversity of programs. And more than that, by its use it creates a closer union among the lecturers with the State Lecturer. This is an advantage; it gives opportunities to give as well as receive and the conscientious lecturer strives to do this.

Grange extension work has been a regular part of each bulletin for the past three years. The reading or discussing of a good book by all the members of the Grange centers the mind upon certain questions, it gives information to those not advised and gives permanency to the program. We believe this is both helpful and needed. The study of parliamentary practice during the past year has not been as general as has been the extension work of the previous year. There are reasons for this—it was more difficult, requiring a closer application, nevertheless there has been 221 copies of Waples' Parliamentary Practice placed in the Granges. Its usefulness will not end with this year. It will always be a handy reference book upon all questions involving parliamentary decisions. In contemplating the furtherance of this part of the lecture work, we have given much thought to the selection of such a book as will appeal to all progressive farmers as instructive and practical in the daily work of farming. Therefore, we would recommend to our successor and to this State Grange the adoption of James' Practical Agriculture for the course of reading in Subordinate Granges for the year 1903."

That the plan of encouraging uniform programs by means of a text book is meeting with favor is shown by the call so far this year for upwards of 400 copies of the work on practical agriculture.

The legislative department has urged measures advocated by State Grange upon the legislature as in former years. It notes with particular satisfaction the almost complete extension of rural mail deliveries over the lower peninsula as a direct result of Grange legislative work in the past and points to it as an example of the fact the farmers' organizations benefit even those who do not directly associate themselves as members of any society.

JENNIE BUELL,

Secretary State Grange.

STATE ASSOCIATION OF FARMERS' CLUBS.

Another cycle has been measured off since our last report. The past year has been one of growth in the Farmers' Club movement. Many new clubs have been organized, a few have fallen by the wayside. The membership of the clubs is increasing, and a greater variety of topics are being discussed, showing that farmers are waking up somewhat. There is still room at the top, and every effort should be put forth to reach the summit and then occupy it.

There is an imperative demand for a closer union, greater harmony among the farmers. For ages precedent has been adverse to organization among the rural population; and it is not the easiest thing in the world to form an organization in the country, let alone maintaining it.

Agriculturists as a class seem to be opposed to organization; look around you; what percentage are members of a farmers' organization? About one in ten.

The farmers that are members of the Farmers' Club and Grange form but a small proportion of the people of this State, yet the influence they wield is vastly superior to the combined efforts of the great majority outside. Wherein lies the difference? One is organized effort, the other unorganized.

Think not that I disparage the work being accomplished by Farmers' organizations. By no means. They are doing a grand work; only we want to do more. Bring more into the present clubs and granges, and organize and organize, until not one shall be outside the fold. Good work is being accomplished all along the line, but we must not be content to let well enough be good enough. Regardless of what has been accomplished, what is being accomplished, there is a greater work to be done than has been or is being accomplished. Farmers must wake up to the fact that every line of business except farming is organized, and organized thoroughly for the protection and benefit financially of its members. Let the farmers do the same. If we do not look out for our interests no one will for us.

The world is advancing, and advancing rapidly along every line of business. Can the farmer afford to stand still? Can the farmer in this ad-

vanced age be without intelligence and command the respect and admiration of society? The mere "dirt groveller" belongs to the barbaric age; soul and brain form an excellent combination for the present civilization.

The work of Farmers' organizations socially, morally, educationally and legislatively cannot be estimated. But financially, there is much left undone. The farmer is controlled hand and foot by other organizations; and he will continue to be until he rises in his gigantic might and demands his just rights.

The Board of Trade not only fixes the grade upon the wheat the farmer grows, but by the pounding and fighting of the "bulls" and "bears" fixes the price also, while at the same time the farmer supports both animals with a good living, and pays the fiddlers engaged for the dance, by a deduction from the price his crops should bring. The salt trust fixes the price of a barrel of salt to the farmer. No manufacturer of salt that is not in the ring can succeed—he is boycotted. The sugar trust virtually controls the price of sugar; the oil syndicate the price of illuminating oils; the lumber organization controls at least the sale of lumber in a manner so that if a farmer wants to buy a carload of lumber he will have to get it from the agent, paying him a profit, or else buy it at his retail price. It is time for farmers' organizations to become better informed as to the extravagant expenditures of money without adequate returns. Many of the organizations mentioned are necessary and productive of much good, and this is true of all of them no doubt, so far as related to purposes for which they were formed. Only a few of the many organizations existing have been mentioned and these have been named mainly to prove more forcibly the necessity of farmers' organizations to protect their interests.

Organization or co-operation is today the lever that moves the world. We have two grand State organizations for farmers. They are working on parallel lines, dealing with every day problems. They look towards the future, and are means of untold good. The interests, the aims, and the hopes are mutual; and there is mutual fellowship and brotherhood between the two organizations.

But the end is not yet. Why should not the greatest reforms and the most potent influences for good originate in our organization? It is, however, only by concerted action that the desired results can be obtained.

The association is officered as follows:

Officers.

President—Hon. I. R. Waterbury, Highland Station.
 Vice-President—Mrs. J. G. Adams, Oakwood.
 Secretary—Miss Julia Ball, Hamburg.
 Treasurer—Mrs. Anna Edwards, Jackson, R. F. D. No. 1.

Directors.

J. T. Daniells, St. Johns, R. F. D. No. 1, term expires 1903.
 C. M. Flumerfelt, Rochester, term expires 1903.
 L. C. Barer, Wolf Creek, term expires 1904.
 Capt. W. M. Horton, Fowlerville, term expires 1904.
 A. L. Chandler, Corunna, term expires 1905.
 E. H. Richey, Vassar, R. F. D. No. 3, term expires 1905.

JULIA BALL,

Secretary.

THE DAIRY INDUSTRY IN MICHIGAN.

BY PROF. R. S. SHAW.

The live stock industry of Michigan has not been developed to the extent that the existing conditions will permit.

According to the census of 1900, this State ranked thirteenth among the states of the Union, with a total valuation of live stock amounting to \$75,999,051.00. On the other hand, however, it is not expected that Michigan should rank among the first in the live stock industry, as large areas are devoted to other lines of business, particularly fruit raising. The percentage of tillable land is not as large in Michigan as in some other states, owing to the ruggedness of some portions. There is still, however, room for both development and improvement, especially along the line of dairying. According to the census quoted above, Michigan ranked twelfth among the states in number of dairy cows with 534,000.

The natural conditions found in the greater portion of the State of Michigan are preeminently adapted to the dairy business. The climatic conditions are not extreme; the cold is not prolonged and severe in winter, and the same is true of the heat in summer. The precipitation is such as to render the production of forage, fodder, soiling crops and pasture, in abundance, a certainty. Our lands are well interspersed with living streams and lakes furnishing excellent water. Michigan is the home of corn and clover, two essentials in the dairy business. In some sections there are large areas of low lying lands, too wet to produce crops without drainage. With the present prices and scarcity of labor, the farmer can scarcely afford to reclaim these lands, and even if reclaimed under present conditions, but little profit would be received from them under a cash crop system. If such lands are not so excessively wet as to produce the coarser sedges, no better return can be secured from them than that made by the dairy cow. In fact, the dairy farmer possessed of such land, producing a fair quality of grass, is in a way fortunate, as these conditions produce succulent feed at a time when the meadows are brown and sear.

Some portions of Michigan are badly in need of the dairy industry to restore fertility to lands exhausted by continuous cropping. The question frequently arises, how does the keeping of dairy cows tend to increase the productiveness of the farm more than other lines of live stock? The answer is found in the fact that through keeping the dairy cows and feeding the products of the farm to them, the maximum amount of fertilizing material is left to return to the land. In the operations of dairy feeding it becomes possible for the dairyman to purchase rich, concentrated feeding stuffs, which, after feeding, leave additional fertilizing material. When farm crops are fed to live stock and converted into marketable or manufactured articles, they will return a much greater revenue than can be secured from the sale of the crops in the crude form. The sale of the entire crop, each succeeding year, removes the plant foods from the soil slowly but surely and produces

undesirable physical conditions in the soil which cannot be overcome through the use of artificial fertilizers alone. In feeding beef cattle, sheep and swine, about the same percentage of the food consumed is voided in the form of liquid and solid excrement as in the case of dairy cattle; but when the meat producing animals are marketed, large quantities of plant food leave the farm. The fat steer or heifer goes to market at from twenty-four to thirty months of age, while a good dairy cow remains for a period of ten years, or even more. In the bone, muscle, tissue, etc., of the steer, large amounts of phosphoric acid, nitrogen and potash, are carried away, while a pound of butter consists largely of carbon, hydrogen and oxygen, of which there is such an abundant supply that the plant is seldom, if ever, in need of them.

The method chosen to dispose of dairy products will materially influence the amount of fertilizing material left behind. Considering the matter from this standpoint, that method of procedure by which the skim milk is retained for feeding purposes, is the best. It can then be used in rearing both calves and pigs, when a large part will go back to the farm as fertilizer. Less fertilizing material is removed from the farm when butter is manufactured; more material is removed by the cheesemaker, and whey, a less valuable product than skim milk, is sold outright. That method of dairying which leaves the skim milk on the farm for feeding, cannot be too highly commended.

In support of the arguments produced, we quote from the annual report of the Wisconsin State Dairymen's Association for the year 1902. The synopsis hereafter given is from an address, entitled "What Dairying has done for Trempealeau County," by A. A. Arnold. This story, unquestionably authentic in every respect, reads like a fairy tale; it should be scattered far and wide. Lands were first settled in Trempealeau county in 1852, the early settlers being mostly American born with a few Scotch, English and Irish. The best lands were settled by these people. From 1860 to 1868 large numbers of Polish, German and Norwegian emigrants settled in this county. Trempealeau county is possessed of a variety of soils. "Streaks of sand on one side or the other of all large streams, deep rich valleys of loam and rich clay soil to the tops of the bluffs." From the earliest settlement, up to 1881, little attention was given to dairying or stock raising. The land was persistently cropped till it failed to produce. After fifteen or twenty years of grain farming, these farmers found themselves worth little more than when they began, with mortgages on four-fifths of the farms in the county; at least half of the mortgages were foreclosed or deeded to the mortgagee. Trempealeau county was naturally rich and suited to the production of corn, oats and pasture. These crops, combined with good climatic conditions, made it an ideal dairy country. Shortly after 1881, the farmers began to erect cooperative creameries and make butter. As a result, we find that in 1901 seven-tenths of the Trempealeau county farmers were out of debt. Lands, that in 1881 were worth but from \$2.00 to \$20.00 per acre, are now worth from \$10.00 to \$70.00. Good farm houses and commodious barns predominate and the shack and hovel are the exception. Stock raising has increased the productiveness of these holdings. Twenty years ago there was not a bank in

Trempealeau county and the farm mortgages were held by outside parties. Today the county has seven banks, with deposits from farmers amounting to \$426,000. The few mortgages still in existence are held by the farmers within the county. Notwithstanding the fact that the great bulk of the farm produce is fed to live stock, still this county now ships more surplus grain than she did twenty years ago before dairying began. In 1901, Trempealeau county shipped 1,191 carloads of grain, 465 cars of hay, 134 cars sheep, 280 cars cattle, 610 cars hogs, 120 cars flour and 70 cars of butter. These 2,888 carloads brought a return of \$1,444,000. These marvelous achievements are attributed to the influence of the dairy industry backed up by patient, industrious persevering men, women and children.

BUILDING UP A DAIRY HERD.

One of the first essentials in an undertaking of this kind is the necessity for a correct, well defined and fixed idea of the proper methods of procedure. While it is true that experience teaches while we progress in any line of business, it is also true that we cannot rush blindly into such a complex problem as dairy breeding without some knowledge of the governing principles. We must seek the necessary knowledge from whatever source it can be obtained. The weekly or monthly dairy paper, bearing the experiences of the most successful and practical men, is a great source of reliable information. Others are found in farmers' institutes, dairymen's conventions, and short courses in dairying and stock judging, such as the various agricultural colleges offer.

One of the first things for the dairy beginner to decide upon is the breed he will use. This is absolutely necessary; even if for the first few years he is possessed of but one pedigreed animal only, viz., the bull. Changing from one breed type to another is disastrous. Nothing but continuity of purpose and fixed practice can lead to the highest success in breeding dairy cattle. After deciding on the kind of blood to be used, much valuable information can generally be secured from the breeders' organizations, or registry associations, interested in the development of the particular breed chosen.

The beginner in the dairy business will surely find sooner or later that he must breed the best dairy cows; few good ones are offered for sale except when herds are dispersed. To start into the dairy business does not mean that a complete herd of pedigreed animals must be purchased at first, for this would be beyond the means of the average farmer and a practice to be indulged in only by those of means. We propose discussing a plan of procedure within reach of the average individual.

UP-GRADING.

The proposed plan is that known as up-grading, which consists in ingrafting the characteristics of a superior breed upon an inferior one for the purpose of improving the latter. This improvement is due to the superior quality of the males used and chiefly their power of transmitting accurately these qualities to the offspring. The first step must be that of purchasing the best type of grade cows which can be secured at moderate cost by careful selection. If possible, one or two registered

females of the same breed as the sire to be used should also be procured. These will add additional interest to the methods of breeding and the care exercised, and it is surprising in what a short time the progeny of one or two females will develop into a good full-blood herd.

When once the cows are purchased and the bull selected, then let there may be no swerving of purpose or deviation of plan. The same line of blood must be used continuously. The intermixtures of blood are the causes of so many inferior types and no purpose animals.

It is, therefore, necessary that the best possible type of bull be secured. To obtain these, moderately large prices will have to be paid. In making the proper selection, one must be possessed of correct ideas of breed and bull type. In choosing a dairy sire, I would want to know first about his ancestry. He should have a good mother with a strong line of ancestry. Concentration of good blood and individual excellence, is the surest means of its perpetuation. It is a much more difficult task to choose among bulls than fully developed cows. The individuals comprising the female ancestry of the bull should be possessed of fair size and vigorous constitutions, but chiefly large producers of milk of good quality. A dairy bull should comply with the following requirements, viz.:

1. Head must be strong and masculine and full of character and vigor, broad between the eyes, clean cut and well defined, the eye full and prominent.

2. Neck neatly joined at head and shoulders, only medium in length and somewhat arched and large in the muscles, indicating strength and vigor.

3. The forequarters should be strongly developed with good depth and width of thorax or chest, showing great strength of constitution.

4. The coupling should be relatively shorter and more compact than that of females, with straight, strong, prominent back and wide loin. Ribs deep and widely sprung, showing large digestive capacity.

5. Hind quarters long and broad on rumps with the width carried well back, hip bones wide apart, tail set on level with the back, hanging at right angles to it and tapering toward the end, falling an inch or two below the hocks.

Rudimentary teats should be well developed and set well apart and the milk veins should be easily traceable.

6. Handling qualities. Skin, though thicker and heavier than that of the cow, should be loose, soft, pliable, mellow and elastic with a good covering of hair of a soft silky nature.

General Appearance: Should be that of strength and vigor with activity devoid of viciousness.

These few suggestions relating to bull type, must needs be general rather than specific, owing to the great variation in breed type.

SELECTION OF COWS.

There is great diversity of opinion regarding dairy type and form among cows. We are constantly discovering variations in the performance of individuals of similar types. But even though this may be the case, it is necessary for the breeder to follow some standard in breeding and selection. In breeding pedigreed animals, the standards established

by the various breed associations, must be followed. In that process of up-grading, however, which consists in the improvement of the common stocks, and which must be employed by the great majority of dairy-men and farmers; the detail of breed standards is unnecessary. In this work of up-grading the breeder requires a practical and, at the same time, simple standard. Hence we submit the following points as being the more important essentials of a good dairy cow, viz.:

1. Much length or depth in the barrel or coupling indicating a large consumption and utilization of food.
2. Refinement of form as indicated more particularly in the head, neck and withers, incurving thighs and fine, well formed limbs.
3. Good development of udder and milk veins.
4. Constitution as indicated by a capacious chest, much width through the heart, a broad loin, a full, clear eye; and an active carriage.
5. Downward and yet outward sprung and open spaced ribs covered with a soft, pliable, elastic skin.

It is necessary that the cow should have a large digestive apparatus. In order to be a large producer, she must be developed for the consumption, digestion and assimilation of large quantities of food. Look first for depth through the center, from the middle of the back to the navel, with large, deep, wide spread ribs, indicating width of body even bordering on paunchiness. In general, females with small, cylindrical couplings, are not large milk producers. Moderate length of coupling is desired and though a straight back in the dairy cow is preferable, these are the exception in the heavy producers.

Having examined the cow as regards her ability to consume a large quantity of food, we next want to know what use is to be made of the food, whether converted into meat or milk, and we proceed to search for the indications of refinement of form shown in the clean cut head, devoid of fleshiness, with broad dished forehead, large mouth, muzzle and nostrils and a large prominent, active intelligent, but not nervous, eye. The neck should not be heavy but rather long and slim, the withers sharp and the thighs incurving, rather than straight or full.

Having estimated the ability of the cow to consume food and utilize the same for maintenance and milk production, the next essential feature to know about is the udder. This should be large and well-formed, of good quality and with teats of convenient size and well placed. The milk veins are most desirable when large and tortuous, passing through the abdominal wall through large openings.

Too much attention can not be given to the question of strength of constitution in the dairy cow, as shown in the deep chest with increasing width downward, providing ample room for vigorous heart and lung action, and in the indications that these functions are properly performed as shown in the condition of skin and hair.

The selection of females from among dairy heifers is a somewhat difficult task, particularly among calves and yearling heifers, and in fact there is danger of misjudging the young cow even during the first period of lactation. In this kind of selection much stress must be attached to good ancestry, even though the offspring of good cows are not all invariably good. This last statement may be questioned by those who may have observed that record making cows do not always produce

record makers. It must not be forgotten, however, that the record is produced through forced feeding which may tend to impair the reproductive powers of the cow and even sacrifice her entirely. The most rigid selection must take place, not among the calves and heifers alone, but among the producers also. In order to select wisely, something more than casual observance is necessary and a record of each individual must be kept. We have great faith in the use of spring balances and Babcock testers; these are the two potent factors in building up the dairy herd. Weigh up every milking, recording the weight on a weigh sheet, and transfer to a herd record book once a week, testing frequently for butter fat. In this way we know exactly what each cow produces during each period of lactation, and we are able, without doubt, to discard the least profitable ones. But, it is objected that such methods involve too much labor. We answer that the extra labor involved will be repaid abundantly. Any falling off in the milk flow is readily detected, and the cause can be sought out and possibly removed. Records are made during a season which, as a rule, imbue the dairyman with ambitions to improve his herd each succeeding year.

The question of size in dairy types has been a matter of much discussion among dairymen and the prevailing practice of breeders has been to breed heifers at a very early age, in many instances bringing them into motherhood as early as nineteen or twenty months of age. This method has a marked tendency toward the reduction of size. And is it not correct to assume that constitutional vigor will also be sacrificed in time? According to a late report from the Wisconsin Experiment Station, the results of a number of years testing cows of various types, indicate that the large dairy type will be found the most satisfactory for the dairy farmer.

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